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ABSTRACT

This monograph summarizes a study of employer activities in regard to manpower planning and forecasting. While the study did not purport to cover a representative sample of firms, it did identify approaches used by various businesses within the state of Minnesota. The findings of the study are supplemented by bibliographical materials which will assist in making private manpower planning more adequate. Also, an attempt has been made to: (1) generalize from the survey findings, (2) provide case examples, (3) analyze problems encountered in planning, and (4) develop some basic guidelines for manpower planning by individual firms. Major sections of the monograph are: (1) The Character of Manpower Planning and Forecasting, (2) Forecasting Techniques: A Review and A Model, (3) The Minnesota Forecast Survey, (4) Case Examples From the Minnesota Survey, (5) Problems and Guidelines for Micro Manpower Planning, and (6) Research Needs. A selected bibliography of 48 items on manpower planning and forecasting in the firm is included. (Author/JS)

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EMPLOYER MANPOWER PLANNING AND FORECASTING

U.S. DEPARTMENT OF LABOR
J. D. Hodgson, Secretary

Manpower Administration

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PREFACE

Only recently has American management generally become concerned with formal manpower planning. There is great variability in approach, policy, and practice. Much of the experimentation currently underway is not reported in the literature; it is diffused, scattered, and not generally known even to other private manpower planners. This monograph on manpower planning by private firms is an effort to make available more information about such planning.

Sponsorship of this monograph, and the survey on which it is based, by the Manpower Administration of the U.S. Department of Labor exemplifies the active interest of the Federal Government in manpower planning in the private sector. As Arnold Weber has written:

It is obvious that the process of skill acquisition and allocation of the labor force will be carried out primarily through the autonomous efforts of individuals and enterprises in the private sector.¹

Moreover, the national pursuit of an active manpower policy has increased business concern with its own wider social responsibilities, so that, as Arthur W. Saltzman of the Ford Motor Co. put it:

In 1968, the Federal Government acquired a new manpower partner, the American business community. It is likely that neither partner will ever again be quite the same.²

Although the appropriate mix between public and private planning is not known, it is clear that both are needed, their functioning needs to be improved, and their relationship needs to be clarified, made explicit, and tested. In fact, the Department of Labor has responsibility for the improvement of manpower planning and forecasting in both the public and private

sectors under the Manpower Development and Training Act of 1962 and under the 1968 amendments to the Vocational Education Act. The Department's activities in this area are summarized in the *1969 Manpower Report of the President*, with its emphasis on an active manpower policy.³ Department of Labor research has provided a wide variety of information not only on manpower supplies and requirements, but also on the techniques and methods of making projections. The activities of the Manpower Administration's Office of Policy, Evaluation and Research (OPER), in particular, have helped to expand the meager fund of knowledge on manpower planning and forecasting.⁴ OPER support for developmental studies has advanced the Department's work in two key areas. Studies of job vacancies or job opportunities are now beginning to help fill a strategic gap in data on labor demand,⁵ and national manpower projections have been issued with guides to

¹ See especially pp. 1-17 for the historical record of the development of manpower policies; concern with manpower requirements and resources is summarized on pp. 155-165 of the *Manpower Report of the President, including A Report on Manpower Requirements, Resources, Utilization, and Training by the United States Department of Labor, Transmitted to the Congress January 1969* (Washington: U.S. Department of Labor, 1969).

² See *Manpower Research Projects Sponsored by the U.S. Department of Labor, Manpower Administration*, which is issued annually and contains a complete listing of research reports sponsored by OPER. It is available upon request to the Manpower Administration. All of these reports may be purchased from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151.

³ See *1969 Manpower Report*, pp. 160-161; see also John G. Myers and Daniel Creamer, *Measuring Job Vacancies, A Feasibility Study in the Rochester, N. Y. Area* (New York: National Industrial Conference Board, 1967), *Studies in Business Economics* No. 97; and Myron L. Joseph, "Job Vacancy Measurement," *The Journal of Human Resources*, Fall 1966, pp. 59-80. See also Howard V. Stambler, "New Directions in Area Labor Force Statistics," *Monthly Labor Review*, August 1969, pp. 3-9; and John G. Myers, *Job Vacancies in the Firm and the Labor Market* (New York: National Industrial Conference Board, 1969), *Studies in Business Economics* No. 109.

¹ *Public-Private Manpower Policies*, eds. Arnold R. Weber, Frank A. Cassell, and Woodrow L. Ginsburg (Madison, Wis.: Industrial Relations Research Association, 1969), p. 1.

² *Ibid.*, p. 79.

their use as a text in developing State and area manpower projections.⁶

Although this research may be of some help to manpower planners in private industry, it does not provide "how-to-do-it" guides for individual firms. Recognition of the need for such guides led OPER to sponsor the study reported in this monograph.⁷ That study sought to learn what employers in Minnesota were doing in their manpower planning and forecasting. It did not purport to cover a representative sample of firms; instead, it was concerned with the approaches used by the surveyed firms, in the hope that their experience would be useful to those with similar problems.

In this monograph the findings of the study are supplemented by a summary and synthesis of some of the basic approaches to private manpower planning and extensive references to bibliographical materials which will assist in efforts to make private manpower planning more adequate. An attempt has been made to generalize from the survey findings, to provide case examples, to analyze problems encountered in planning, and to develop some basic guidelines for manpower planning by individual firms. Hopefully, the monograph represents a beginning in one of the most challenging and important areas of manpower research.

H. G. Heneman, Jr.
George Seltzer

⁶ *Tomorrow's Manpower Needs, National Manpower Projections and a Guide to Their Use as a Tool in Developing State and Area Manpower Projections* (Washington: U.S. Department of Labor, Bureau of Labor Statistics, 1969), BLS Bulletin No. 1606 (vol. I, *Developing Area Manpower Projections*; vol. II, *National Trends and Outlook: Industry Employment and Occupational Structure*; vol. III, *National Trends and Outlook: Occupational Employment*; vol. IV, *The National Industry-Occupational Matrix and Other Manpower Data*).

⁷ H. G. Heneman, Jr., and George Seltzer, *Manpower Planning and Forecasting in the Firm: An Exploratory Probe* (Minneapolis: University of Minnesota, Industrial Relations Center, March 1968). Copies of this study may be purchased from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151 (\$3 for paper copy; 65 cents for

microfiche). Specify title and accession No. PB 179078 with order and enclose remittance.

The material in that report and in this monograph was prepared under the authority of title I of the Manpower Development and Training Act of 1962, as amended. Researchers undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment. Therefore, points of view or opinions stated in this document do not necessarily represent the official position or policy of the U.S. Department of Labor.

An important byproduct of the study was a series of bibliographies on all phases of manpower planning: N. P. Sinha and others, *Manpower Planning: A Research Bibliography* (Minneapolis: University of Minnesota, Industrial Relations Center, January 1970), Bulletin 52 (revised ed.).

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The authors acknowledge with thanks and appreciation the significant role of several persons responsible for the survey on which this monograph is based. From the University of Minnesota Industrial Relations Center staff, recognition is given to Timothy J. Keaveny, Paul C. Nystrom, George T. Milkovich, A. Edward Hunter, Madan Saluja, Earl Vitalis, Donna D'Andrea, Georgianna Herman, and Richard J. Snyder.

Credit is also due to the many companies and their representatives who worked so hard and well to make this survey possible. The following merit special recognition: Wendel W. Burton, 3M Co.; Raymond W. Carlson and Floyd Holm, FMC Corp.; Alex Chudyk, Honeywell, Inc.; Richard D. Connor, Control Data Corp.; Marshall J. Diebold, Northrup King and Co.; J. J. Kelso, Northwestern Bell Telephone Co.; Thomas J. Pierce, Ashland Oil and Refining Co.; Floyd Rodmyer, Whirlpool Corp.; Gerald P. Thilgren, IBM; and Roy Yamahiro, General Mills, Inc.

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THE CHARACTER OF MANPOWER PLANNING AND FORECASTING

Circumstances That Generate Planning

Severe manpower shortages such as those during World War II had, until the 1960's, been the principal occasion for manpower planning. The brief wartime experience with manning tables and personnel inventories made good sense, but they were generally dropped after the war because they seemed unnecessary in what was assumed to be a labor surplus economy.⁸ Planning tended to be restricted to those occupations in which manpower development required a sizable lead time and, after Sputnik in 1957, to those which were regarded as crucial in advancing the Nation's technological standing.

During the early 1960's, recognition of the crucial role of manpower development in reducing unemployment, coupled with fears that widespread unemployment would result from automation and unprecedented expansion of the labor force as the first postwar generation reached working age, gave new impetus to manpower planning. In the first *Manpower Report*, President John F. Kennedy wrote:

Manpower is the basic resource. It is the indispensable means of converting other resources to mankind's use and benefit. How well we develop and employ human skills is fundamental in deciding how much we will accomplish as a nation.

The manner in which we do so will, moreover, profoundly determine the kind of nation we become.⁹

⁸One survey, a decade after the war, found little manpower planning and forecasting. See Frederick Harbison, "Manpower and Innovation: Some Pointers for Management," *Personnel*, November-December 1959, pp. 8-15.

⁹1963 *Manpower Report*, p. xii. Manpower planners should have all of these annual reports on hand. They are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

As the economy soared during the 1960's, tightening labor markets prompted growing numbers of employers to initiate planning to meet at least part of their manpower needs. Today several other forces are driving employers toward manpower forecasting.

First is the increased sophistication of a new and improved cadre of managers; they are used to, and love, complex and tough problem solving. In addition, the renewed emphasis upon "management by objectives" has brought planning squarely to the forefront of management functions.¹⁰

Second, the Federal Government has influenced manpower planning activities in several ways. It is finally seeking meaningful job vacancy (and labor demand) information for training and retraining.¹¹ It has forced firms with Government contracts to study and justify alleged manpower requirements, pushing especially hard the concepts of learning curves in new product development.¹² The Federal Government has been the biggest and most effective promoter of the systems concept—most spectacularly in the space area, but with great effect in other situations.

¹⁰P. J. Chartrant, "Manpower Planning—A By-Product of Management by Objectives," *Business Quarterly*, Spring 1969, pp. 65-73; also "Decision-Making in Manpower Planning," *Operation Research Quarterly*, April 1968, pp. 129-132.

¹¹Cf. M. A. Zaidi and others, *A Preliminary Bibliography on Job Vacancies* (Minneapolis: University of Minnesota, Industrial Relations Center, 1967); John G. Myers, op. cit.

¹²Cf. Winfred B. Hirschmann, "Profit from the Learning Curve," *Harvard Business Review*, January-February 1964, pp. 125-139. These learning curves should not be confused with "human learning curves" used in education and training programs: Cf. A. R. Knowles and L. F. Bell, "Learning Curves Will Tell You Who's Worth Training and Who Isn't," *Factory Management and Maintenance*, June 1950, pp. 114-115 ff.; also William McGehee, "Cutting Training Waste," *Personnel Psychology*, Autumn 1948, pp. 331-340. See also Malcolm S. Cohen, "Micro Data in Manpower Study," *Monthly Labor Review*, April 1969, pp. 53-54.

Third, cooperation between Government and business on employment, housing, and urban renewal for the disadvantaged has supported the spread of planning concepts. It is essential to determine manpower needs before giving manpower training, and manpower planning thus becomes the key to a joint venture between business and Government.

Fourth, within organizations, emphasis upon manpower development leads naturally to manpower planning. Cost-benefit considerations lead to comparisons of internal and external labor markets as optional and optimal sources of supply. Widespread recognition of managerial and technical manpower obsolescence, with attendant needs for retraining, tends to call for more manpower planning. So does renewed emphasis upon career development and progression.

Fifth, while national or economywide manpower planning may provide some general clues to preventing and solving manpower problems, in a free enterprise economy the effective manpower decisions are made by individuals and employing organizations.

One of the best summaries of reasons underlying corporate concern with manpower planning is provided by Frank Cassell.¹³ He hypothesizes that current and anticipated manpower shortages provide the principal motivation for interest in the subject. He reasons that the Nation's efforts to implement its commitment to full employment have a varying impact upon firms (and occupations, industries, and regions) because of differentials in employers' needs for skills, knowledges, and experience and their access to supplies possessing these requisites. Workers who do possess these attributes are readily trainable, while those who lack the basic qualifications require special job preparation even for entry-level positions.

Growing shortages of qualified manpower have been caused by several forces. Technological and other developments have increased the need for more high-talent manpower and raised the qualifications for an increasing number of occupations, especially in professional, managerial, and technical fields. Technological developments also increase manpower obsolescence and necessitate almost continuous adaptation and retraining of current employees, some of whom are either unwilling or unable to keep pace. At the same time, a wider range of job options has opened up to the highly qualified entry worker; such workers are weighing the choices between business and careers in the professions. More and better manpower of new types is also called for in the effort to raise standards of living

to encompass optimal education, health protection, and a better social and cultural (as well as economic) environment for all.

These manpower abstractions become realities to the employer, Cassell argues, in the form of manpower shortages—current and future. The employer's first response may be intensified recruiting and inducing employees to leave other firms by offering higher salaries. Such wage bidding may distort wage structures; in essence, it transfers the shortage problem from one employer to another at a higher price with each successful bid. The employer's next step may be to seek additional options—such as substituting machinery for manpower, diluting jobs, or upgrading. In the short run, however, it is often impossible to develop replacements for needed workers in some occupations. In such cases, management may have either to continue to pirate talent or to recruit and develop its own. Thus firms begin to compare internal and external labor markets, their relations and interactions.¹⁴ Such comparison leads to identifying possible options, decisions, costs, and alternatives of ever-widening scope. As the area of possible action widens to include not only recruitment, but also training, compensation, and labor-management relations, firms begin to realize that manpower planning must enhance *all* personnel and labor relations functions, both line and staff. Because of the infinite number of variables involved, what emerges is a systems concept,¹⁵ with the outcome essentially the solution of a set of simultaneous equations. Thus what has been traditionally a series of separate and, apparently, unrelated manpower decisions is tied together in a way that maximizes decision options and cost-benefit trade-offs.

¹⁴ Peter B. Doeringer, "The Determinants of the Structure of Industrial Type Internal Labor Markets," *Industrial and Labor Relations Review*, January 1967, pp. 206-220; *Work Force Adjustments in Private Industry—Their Implications for Manpower Policy* (Washington: U.S. Department of Labor, Manpower Administration, 1968), Manpower/Automation Research Monograph No. 7; H. M. Gitelman, "Occupational Mobility Within the Firm," *Industrial and Labor Relations Review*, October 1966, pp. 50-65; Clark Kerr, "The Balkanization of Labor Markets," in E. Wight Bakke and others, *Labor Mobility and Economic Opportunity* (Cambridge, Mass.: Technology Press of MIT, 1954).

¹⁵ Cf. Herbert G. Heneman, Jr., "Conceptual Systems of Industrial Relations," *Manpower and Applied Psychology*, vol. 1, No. 2, 1968 (available as Reprint 57, University of Minnesota, Industrial Relations Center, Minneapolis). For a very simple reference on manpower systems, see Herbert G. Heneman, Jr., and Dale Yoder, *Labor Economics*, 2d ed. (Cincinnati: South-Western Publishing Co., 1965), ch. 4 and app. A; for a more sophisticated treatment, see Walter Buckley, *Sociology and Modern Systems Theory* (Englewood Cliffs, N. J.: Prentice-Hall, 1967), pp. 1-81.

¹³ Frank H. Cassell, *Corporate Manpower Planning* (Minneapolis: University of Minnesota, Industrial Relations Center, February 1968), Special Release 6.

Links Between Public and Private Planning

Manpower planning carried out by the employing organization for its own purposes, or *micro* planning, resembles that initiated by the Federal Government on an economywide base, or *macro* planning, in many respects. This similarity results partly from the complex framework of the free enterprise, highly industrialized, decentralized, and democratic society in which planning is done, and the consequent need to provide linkages between and among individual employees, employers, unions, and governmental, educational, and social agencies. In manpower planning, one such linkage is provided by the interchange of data, whereby firms may use national or regional labor force data in drawing up their plans and government agencies may collect data from firms to provide aggregate manpower measures, as on job vacancies. Moreover, both micro planning and macro planning reflect a basic concern to insure that manpower resources are committed, developed, applied, utilized, and conserved. In both cases, also, planning is highly complicated by the need for much more knowledge about human behavior in general and employment behavior in particular.

Many of the concepts, problems, and methodologies of macro planning are not only similar to, but may prove useful in, micro manpower planning. The micro planner should therefore be aware of some of the major literature on macro plans and forecasts, which is listed in the footnotes to this section.

Obviously, a major aim of macro manpower planning is to provide guidelines for national manpower policies and programs. The policies and programs discussed in the annual *Manpower Report of the President* are good examples of such a use. More specifically, Richard Lester has suggested that:

... manpower planning aims to enlarge job opportunities and improve training and employment decisions, through the power of informed personal choice and calculated adjustment to rapidly changing demand. By means of more intelligent training and career decisions and greater adaptability of the nation's labor force, manpower planning can enhance satisfaction on the job, raise the quality and utilization of labor resources, reduce the cost of job search and industry staffing, and, thereby, increase the output of the nation.

Properly conceived, manpower planning in our type of economy works with market forces. It does not seek to restrict individual choice or to displace market processes.¹⁶

¹⁶ Richard A. Lester, *Manpower Planning in a Free Society* (Princeton, N. J.: Princeton University Press, 1966), p. 5. See also E. Wight Bakke, *A Positive Labor Market Policy* (Columbus, Ohio: Charles E. Merrill Books, Inc., 1964); Robert A. Gordon, *Toward a Manpower Policy* (New York: John Wiley and Sons, Inc., 1967); Eli Ginzberg, *Manpower Agenda for America* (New York: McGraw-Hill Book Co., Inc., 1968); Leonard A. Lecht,

Macro projections of population, labor force, and employment are of great value at national, local, and regional levels.¹⁷ Occupational forecasts and, perhaps to a somewhat lesser degree, industry employment estimates are in considerable demand,¹⁸ as are projections for scientific and technical personnel.¹⁹

Closely related to these purposes are studies of education, manpower, economic growth, and development.²⁰ Human resource development²¹ and

Manpower Needs for National Goals in the 1970's (New York: Frederick A. Praeger, 1969); *Manpower Tomorrow: Prospects and Priorities*, ed. Irving H. Siegel (New York: Augustus M. Kelley, 1967); *Manpower Planning and Forecasting*, Proceedings of the 10th Annual Research Conference (Los Angeles: University of California, Institute of Industrial Relations, 1968); Sar A. Levitan and Garth L. Mangum, *Making Sense of Federal Manpower Policy* (Ann Arbor, Mich.: University of Michigan, Institute of Labor and Industrial Relations, 1967), Policy Papers in Human Resources and Industrial Relations No. 2.

¹⁷ Cf. Sol Swerdloff, "How Good Were Manpower Projections for the 1960's," *Monthly Labor Review*, November 1969, pp. 17-22; *Methodology and Techniques for Long Range Projections of Population, Labor Force and Employment* (Sacramento, Calif.: State of California Commission on Manpower, Automation and Technology, 1965); Howard V. Stambler, "New Directions in Area Labor Force Statistics," *Monthly Labor Review*, August 1969, pp. 3-9; Eli Ginzberg, *Manpower Strategy for the Metropolis* (New York: Columbia University Press, 1968); Arthur P. Solomon, "Community Manpower Planning: An Organizational Perspective," *Proceedings of the 25th Annual Winter Meeting, 1967* (Madison, Wis.: Industrial Relations Research Association, 1968). Two additional basic sources include: *Manpower Projections: An Appraisal and a Plan of Action, Report of the Working Group on Manpower Projections to the President's Committee on Manpower* (Washington: U.S. Department of Labor, Manpower Administration, 1967); and Harold Goldstein and Sol Swerdloff, *Methods of Long-Term Projections of Requirements for and Supply of Qualified Manpower* (New York: United Nations Educational, Scientific and Cultural Organization, 1967), ST/s/12.

¹⁸ Cf. Harry Greenspan and Joseph J. Kilgallon, *Occupational Employment Statistics: Sources and Data* (Washington: U.S. Department of Labor, Bureau of Labor Statistics, June 1966), BLS Report No. 305; *Occupational Employment Patterns for 1960 and 1975* (Washington: U.S. Department of Labor, Bureau of Labor Statistics, 1968), BLS Bulletin No. 1599. See also Leslie Fishman and others, *Methodology for Projection of Occupational Trends in the Denver Standard Metropolitan Statistical Area* (Boulder, Colo.: University of Colorado, Bureau of Economic Research, 1966); and Jack Alterman, "Inter-industry Employment Requirements," *Monthly Labor Review*, July 1965, pp. 841-850.

¹⁹ Cf. Bernard Michael, *The Long-Range Demand for Scientific and Technical Personnel: A Methodological Study* (Washington: National Science Foundation, 1961); also David M. Blankard and George J. Stigler, *The Demand and Supply of Scientific Personnel* (New York: National Bureau of Economic Research, Inc., 1957).

²⁰ Cf. two works by Frederick Harbison and Charles A. Myers, *Education, Manpower and Economic Growth* (New York: McGraw-Hill Book Co., 1964) and *Manpower and Education* (New York: McGraw-Hill Book Co., 1965); *Education and Economic Development*, eds. C. Arnold Anderson and Mary Jean Bowman (Chicago: Aldine Publishing Co., 1965); Herbert S. Parnes' classic *Forecasting Educational Needs for Economic and Social Development* (Paris: Organisation for Economic Co-operation and Development, 1965); *Occupational Data Requirements for Education Planning*, ed. Georgianna B. March (Madison, Wis.: The University of Wisconsin, Center for Studies in Vocational and Technical Education, 1966); Louis T. Harms and others, *A Manual for Development of Estimates of Future Manpower Requirements for Training Purposes* (Philadelphia: Temple University, Bureau of Economic and Business Research,

manpower and technological change and development²² are other favorite themes. These broader areas of interest have an impact upon manpower planning at the firm or organizational level, but the ensuing discussion concentrates on the micro level per se.

Micro Manpower Planning: An Overview

General micro manpower planning is concerned with proposed designs and methods of action or procedure in using manpower resources to attain organizational objectives. It is a very broad concept concerned with the totality of manpower management in the employing organization; that is, personnel administration and labor relations. Yet most current efforts at micro manpower planning seem directed toward only the portion of planning called manpower forecasting.²³ A forecast is a tool—a necessary and indispensable step in planning. It is an attempt to appraise the future. But a plan also includes goals, targets, and objectives and programs for achieving them.

The Situation in Business Firms

Most frequently, manpower planning in the individual employment unit, if formalized (as in larger firms), is segmental and specific or, if informal (as in smaller

firms), is haphazard and disjointed. Although there is great variation in both policy and practice in manpower planning, this nonsystematic, disjointed characteristic is pervasive.

A business concern, for example, may formally plan expansion in sales, product development, market penetration rates, capital requirements, and new buildings, but most frequently the firm fails to incorporate and integrate manpower needs and requirements in its projections and plans. And, characteristically, almost all manpower planning by firms is for purposes of expansion—few firms develop contingency plans for contraction.²⁴

Partial manpower planning at the micro level tends to embody almost exclusively the "grocery list" forecasting concept; for example, the firm will have to shop soon for some welders and some molders. At a higher level of sophistication, planners will attach numbers to recruitment needs; for example, three welders and two molders. Often a time factor will be added, and in quite sophisticated firms, a quality dimension as well, usually in the form of job descriptions. But such typical manpower planning is highly specific in objective and ignores other facets of a well-balanced manpower program such as compensation, training, and labor relations.

Resultant potential distortions and side effects in manpower systems are ignored in the planning stages and result in much needless work for personnel departments in "putting out fires." Thus partial manpower planning which seeks to be preventive may have unanticipated consequences—the antithesis of the planning objective. In general, it is best to plan for a total manpower system, not just for a specific function such as recruitment, and it is vital that manpower planning be integrated with total organizational planning.²⁵

Even the limited development of private manpower planning is very uneven from industry to industry. In some industries, planning is used essentially to insure supplies of top professional and managerial talent. In others, it may be used to anticipate and meet a variety of manpower problems peculiar to a particular organization.

This tailor-made approach is highly desirable, provided it yields a complete decision system for the firm and a complete manpower decision system that encompasses all firms and adds up to area or regional plans. Most

1966). See also Grant Venn, *Man, Education and Work: Post-Secondary Vocational and Technical Education* (Washington: American Council on Education, 1964).

²¹Cf. T. W. Schultz, "Investment in Human Capital," *American Economic Review*, vol. 51, 1961, pp. 1-17; Gary S. Becker, "Underinvestment in College Education," *American Economic Review*, vol. 50, 1960, pp. 346-354; and Edward F. Denison's classic, *The Sources of Economic Growth and the Alternatives Before Us* (Princeton, N. J.: Princeton University, Industrial Relations Section, 1964), Research Report Series No. 104.

²²As an example, see Irving H. Siegel, "Technological Change and Long-Run Forecasting," *The Journal of Business*, July 1953, pp. 141-156. For case histories at the firm level, see: E. H. Burack and Frank H. Cassell, "Technological Change and Manpower Developments in Advanced Production Systems," *Academy of Management Journal*, September 1967, pp. 293-308; James R. Bright, *Automation and Management* (Boston: Harvard University, Graduate School of Business Administration, 1958).

²³Manpower forecasts usually predict manpower needs for relatively short time periods. Manpower projections, in contrast, refer to reasonable expectations, usually for longer time periods, that can be used to provide guidelines for action. Thus the purpose of forecasts is prediction, whereas projections often seek to provide a range of values or measurements that are likely to typify a situation in the future.

²⁴For an example of plans to deal with massive layoffs, see *Creative Collective Bargaining*, ed., James J. Healy (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1965), pp. 137-165. See also Albert B. Drul, "The Use of Regression Equations to Predict Manpower Requirements," *Management Science*, vol. 9, No. 4, pp. 669-677.

²⁵See John B. Miner, "An Input-Output Model for Personnel Strategies: Solving Human Resource Problems," *Business Horizons*, June 1969, pp. 71-78.

organizations now have unbalanced, lop-sided systems. In part, this results from the desire for growth, to beat the competition to the punch, and the proprietary stance of most organizations: "Our plans for the future must be kept secret; only a small 'inside' group can know. If we reveal our manpower plans, our competitors will guess what we are up to." Hence, those responsible for manpower planning often lack even the minimal information they need.

Plans for acquisitions, mergers, conglomerates, and other organizational developments frequently fall into the category of privileged information. This is true not only in private industry but also in Government agencies, where local and regional offices may not be informed of the latest thinking in Washington on reorganization, realignment, and general organizational structure.

Organizational (and manpower) change is often regarded primarily as a response to technological change, but this is not the only cause nor always the dominant one. Complex social, psychological, political, and economic forces are at work in a web of relationships that is difficult to unravel and understand. Indeed, this complexity is a big reason for the popularity of systems approaches to management.

In establishing a micro manpower planning function, an organization should recognize the need to develop simultaneously two sets of models: one a conceptual or substantive model that lays out major variables and relationships in the abstract and the other, an operational model that deals with all phases of manpower. These models should be related and integrated.

At the outset of micro manpower planning, answers should be sought for the following major questions:

1. What are the purposes and objectives of our organization?
2. What portions can we plan?
3. How would we relate manpower planning to other aspects of organizational planning—for example, production, finance, and sales?
4. How extensive should our manpower planning be? Should we carry it right down to the level of the individual employee—for example, use individual gap sheets? Should we plan only for groups, such as job families?
5. What information do we need for our planning, whatever its scope? Is it possible to get such information?
6. What manpower planning inputs and outputs are desired? What would they cost? Would the benefits be worth the costs?

7. How long a time period do we wish to use as a basis for planning? Would it vary with our several needs?

8. Who should do manpower planning? Line? Staff? Should it be centralized?

In no small measure, answers to these questions depend upon how the firm views its needs and responsibilities; thus it may be argued that, to a large extent, manpower planning is an attitude.

There is an increasing awareness of the need to build manpower planning efforts around long-range objectives. Thus, in private industry, short-run profit goals are being replaced with a "stewardship of assets" approach; that is, an effort to protect assets, including human assets, and cause them to grow.²⁶ Human assets accounting will work a welcome revolution in managerial thinking and bring manpower planning to the fore of every manager's job duties. Newer and more sophisticated planning and forecasting techniques for internal labor supplies will give the organization much more powerful leverage over a period of time. It is the dynamics of manpower resource movements that so urgently require development of measurement techniques.

Micro Planning in Government

Needs and purposes in manpower planning are about the same for government as for private employers. What is different is some of the variables used in forecasting. Specific programs and projects unique to the government should not obscure the basic identity of micro manpower planning.

Since about one employee in six works for Federal, State, or local government, it is not surprising to find substantial concern with respect to manpower planning and forecasting for public employees. The military establishment has had the longest and probably the most successful experience.²⁷ In general, other government agencies have been less active.²⁸ There have been attempts to project general requirements for medical and

²⁶ Cf. Rensis Likert, *The Human Organization* (New York: McGraw-Hill Book Co., Inc., 1967), ch. 9; R. Lee Brummet and others, "Human Resource Measurement: A Challenge for Accountants," *The Accounting Review*, April 1968, pp. 217-224; James S. Hekimien and C. H. Jones, "Put People on Your Balance Sheet," *Harvard Business Review*, February 1967, pp. 105-113.

²⁷ Cf. *Military Manpower Requirements and Supply, 1959-63* (Washington: U.S. Department of Labor, Bureau of Labor Statistics, 1959), BLS Bulletin No. 1262, and Richard D. Conner and R. V. May, Jr., *Applications of a Computerized Model in Enlisted Personnel Planning* (San Diego, Calif.: U.S. Naval Personnel Research Activity, 1965), Research Report SRR 66-3.

²⁸ For a brief bibliography, see Elaine Woodruff, "Manpower Planning for the Public Service—Selected References," *Public Personnel Review*, January 1967, pp. 65-68.

other occupational groups and for local labor market areas,²⁹ as already noted. But these attempts have not been concerned with direct projections *within* the individual employing unit. This situation is changing, however, and today micro manpower planning is starting in government employing units in much the same manner as in private industry.

For example, the State of Minnesota recently began development of a conceptual model for a State manpower planning system, and began the design and development of a manpower information system to make the plan a reality.³⁰ This model was developed, in part, from the concept of the "Minnesota model" for private industry described in the next section of this report. In brief, the State's project includes the following steps:

1. Develop a catalog of State organizations, functions, operations, and programs.
2. Study current literature and actual practices in manpower planning.
3. Develop a historical and current work force information base. This includes employment, turnover,

and skills data, plus identification of major occupational groups, career ladders, and ports of entry through which new employees enter the State service.

4. Relate data on employment histories and occupational structures to predictive variables (both internal and external factors) such as new programs in agencies and changes in population growth, personal income, and economic activity and growth.

5. Develop a conceptual model.

6. Develop a manpower planning systems design.

7. Prepare an operational system; develop training courses, guidelines, instructions, and procedures.

8. Continue evaluation and revision based on experience. Evaluation will be made in terms of objectives. Is the State's work force adequate in both quantity and quality to meet current and anticipated manpower requirements and goals? If not, what must be done to provide a sufficient force in time?

To repeat, it is likely that many of the same general principles of micro manpower planning will hold for both government and private employers. However, in the pages that follow, the focus is on private firms.

²⁹Cf. Antoinette P. Covington, "Demonstration Project to Estimate Hospital and Medical Service Manpower Needs," and Donald H. Mayall, "Methodology of the Manpower Resources of the San Francisco-Oakland Bay Area, 1960-70," *Methodology and Techniques for Long-Range Projections of Population, Labor Force and Employment* (San Francisco: State of California Commission on Manpower, Automation and Technology, 1965), pp. 207-210 and 177-178, respectively; *American Industrial and Occupational Manpower Requirements, 1964-75* (Washington: U.S. Department of Labor, Bureau of Labor Statistics, 1966); A. J. Berman, "Problems of Manpower Projections in New York State: A Report of Work in Progress," *Economics and Business Bulletin*, June 1966, pp. 21-29; and

Garth Mangum and A. L. Nemore, "The Nature and Functions of Manpower Projections," *Industrial Relations*, May 1966, pp. 1-16.

³⁰See *Manpower Planning and Development* (St. Paul: State of Minnesota, Civil Service Department and State Planning Agency, January 1969); Veikko V. Lepisto, *Manpower Planning System: Research Program Progress Report* (St. Paul: State of Minnesota, Civil Service Department, Sept. 22, 1969); see also V. V. Lepisto, *Turnover: A Prediction in Manpower Planning* (St. Paul: State of Minnesota, Civil Service Department, Oct. 21, 1969), for a discussion of turnover as a predictor in manpower planning (just as in the firm model).

FORECASTING TECHNIQUES: A REVIEW AND A MODEL

Until recently there has been very little study of company forecasting. Although micro efforts involve substantial communications problems and have as their central focus private policy, they can contribute greatly to the objectives of public policy once they are improved sufficiently. As this monograph will show, there is evidence of a growing awareness of need and the development of techniques that suggest that micro manpower planning and forecasting will soon be viable and useful, as well as necessary.³¹

Since forecasting is the starting point or fulcrum for decisionmaking at the micro level, an assessment of forecasting techniques is essential in any review of micro manpower planning. Much of the discussion which follows concerns *direct* manpower forecasts, in which the company makes its own forecasts from within, using manpower data. Less frequently, the company uses *derived* manpower forecasts, based upon other variables believed to be correlated with manpower. Sometimes both are used for checking purposes.

³¹ See Frank H. Cassell, "Manpower Planning: The Basic Policies," *Personnel*, November-December 1965, pp. 55-61; Albert N. Navas and others, *Managerial Manpower Forecasting and Planning* (Berea, Ohio: American Society for Personnel Administration, 1965); W. L. Barnes, "Identifying Manpower Potential," *Meeting the Development Needs of Technical Manpower: A Case Study from North American Aviation* (New York: American Management Association, 1964), A.M.A. Bulletin No. 45, pp. 1-6; Paul L. DeBacco and Robert B. Runyon, "The Manpower Audit: Pinpointing Management's Needs," *Management Review*, April 1963, pp. 22-29; Walter S. Wikstrom, "Planning for Manpower Planning," *Business Management Record*, August 1963, pp. 30-33; W. R. Dill, D. P. Garver, and W. L. Weber, "Models and Modeling for Manpower Planning," *Management Science*, December 1966, pp. 142-167; R. T. Kimball, "Long Range Planning for Human Resource Management," *Personnel Journal*, May 1967, pp. 282-287; and Dennis Pym, "Technical Change and the Misuse of Professional Manpower: Some Studies and Observations," *Occupational Psychology*, January 1967, pp. 1-15.

The State of the Art

Whatever method is used, forecasts call for the collection and organization of the data needed to estimate net requirements and net supplies of manpower, since the aim of forecasting is to assess the relative balance. Both of these processes are based upon assumptions which, in turn, reflect judgments and values. Manpower forecasting is a complex and elusive process. Accordingly, a wide variety of approaches have been tried, with most found wanting. All are difficult, despite the fact that some appear simple whereas others appear complicated.

Some forecast models use statistical and mathematical notations which may make them appear "better" (to the unsophisticated), but the old-fashioned tests of reliability and validity are still crucial. J. E. Morton, in his excellent survey bulletin, *On Manpower Forecasting*, after a long discussion of statistical curve fitting techniques, econometric models, and other methods, concluded:

...it would seem that the more conventional forecasting methods, sometimes termed naive, should be improved rather than discarded; they are all we really have. Bold attempts, however, should be encouraged. They will, if nothing else, generate new hypotheses that require confrontation and testing.³²

Morton called attention to limitations of direct micro manpower forecasts and was critical of the customary lack of knowledge of future manpower requirements. In

³² J. E. Morton, *On Manpower Forecasting* (Kalamazoo, Mich.: The W. E. Upjohn Institute for Employment Research, September 1968), *Methods for Manpower Analysis* No. 2, p. 51. This is a summary of all major techniques, with major emphasis upon macro contexts. For a discussion of direct manpower forecasts, see pp. 20-25; for derived forecasts, see pp. 25-32.

his view (given present knowledge), "... the company forecast method would seem to be only a last resort."³³

Most micro efforts to date appear to have been directed toward high-level manpower needs.³⁴ But, as James Walker pointed out in his 1969 survey article, "... the theory of manpower planning is still very sketchy, and answers to the broad question, 'How?' are still quite limited in scope."³⁵

Herbert H. Meyer, writing in 1967, concluded that "... companies are replacing intuition and the haphazard approach... with highly systematic and carefully planned programs to meet anticipated needs." He observes that "The efficient utilization of human resources may very well be the most important determiner of success in the business world in the coming decade."³⁶ Eric W. Vetter, also writing in 1967, apparently did not feel that firms were at present utilizing (or able to utilize) highly sophisticated research methods and approaches. He limited his study, one of the most basic currently available, to what is practical and possible in the immediate future. He says, "Since the book is written for the person who lacks training in economics and statistics, some analytical tools of potential value are not presented. These include statistical regression and correlational analysis, capital budgeting, economic model building, and Markovian processes for the study of manpower flow problems."³⁷

While few firms are able to use these techniques today, they will soon be more generally used because of their superior results. Meanwhile, less sophisticated methods are being used with some, if not optimal, effectiveness. Indeed, they represent a substantial improvement over what was available a decade or so ago. Thus, for example, Fred Harbison's study of the late 1950's

concluded that most companies had neglected to estimate accurately their future manpower requirements and that greater emphasis needed to be placed upon forward manpower planning.³⁸ In 1964, the research committee of the American Society for Personnel Administration's research report project included eight case studies; only five of the eight "were doing very much" of real significance in managerial forecasting and planning.³⁹ At about the same time Eric Vetter made a survey of some 40 companies engaged in long-range manpower planning and forecasting;⁴⁰ this survey was followed by his text in 1967.⁴¹

These surveys showed that few of the companies studied were actively planning for manpower. Almost none of their micro manpower planning efforts were comprehensive in scope (for example, some firms planned only for professional and managerial recruiting). Simple extrapolation of internal demands was the most common method of planning. Initially, primitive plans contained such postulates as: "If sales go up 10 percent, we'll need 10 percent more help." But it was realized that this assumption did not apply to all positions—that, for example, the firm would not need to add one-tenth of a sales manager more or that, if the plant was running at 80 percent "capacity," it might be able to increase output with few, if any, added workers. Then, of course, it was essential to anticipate technological and other changes, for that is the heart of planning. Gradually, the complexity of the problem and the number of options and alternatives available began to be apparent—and a variety of manpower plans were undertaken for a variety of related manpower purposes. Vetter laid out a model system relating manpower planning to profits by measuring productivity (via real dollar value added).⁴² He fully recognized the limitations of productivity measures,⁴³ but emphasized that a planner has to start somewhere. His model and examples are more sophisticated than those generally used today.

The Edwin Geisler 1967 survey of direct company forecast methods showed that most firms continue to use unsophisticated techniques and few use a common

³³ Ibid., p. 20.

³⁴ Cf. *Issues and Problems in Managerial Manpower Planning*, ed. Lois Crooks (Princeton, N. J.: Educational Testing Service, 1967).

³⁵ James W. Walker, "Forecasting Manpower Needs," *Harvard Business Review*, March-April 1969, p. 153.

³⁶ Herbert H. Meyer, in Lois Crooks, op. cit., p. 117.

³⁷ Eric W. Vetter, *Manpower Planning for High Talent Personnel* (Ann Arbor, Mich.: The University of Michigan, Bureau of Industrial Relations, Graduate School of Business Administration, 1967), pp. 3, 4. (Most of these sophisticated techniques are available in J. E. Morton, op. cit.) See also A. Charnes, W. Cooper, R. Niehams, and D. Shultz, *A Model and a Program for Manpower Management and Planning* (Pittsburgh, Pa.: Carnegie-Mellon University, Graduate School of Industrial Administration, June 1968), Management Sciences Research Report No. 132; and Kendrith M. Rowland and Michael G. Sovereign, "Markov-Chain Analysis of Internal Manpower Supply," *Industrial Relations*, October 1969, pp. 88-99. See also Thomas A. Mahoney, *A Stochastic Model for Manpower Planning* (Minneapolis: University of Minnesota, Industrial Relations Center, 1969); J. W. Merch, *A Markovian Model for Projecting Movements of Personnel Through A System* (San Antonio, Tex.: U.S. Air Force, Lackland Air Force Base, Personnel Research Laboratory, March 1965); and Victor H. Vroom and Kenneth MacCrimmon, "Toward a Stochastic Model of Managerial Careers," *Administrative Science Quarterly*, June 1968, pp. 26-46.

³⁸ Frederick Harbison, "Manpower and Innovation: Some Pointers for Management," *Personnel*, November-December 1959, pp. 8-15; see also Robert Ferber, *Employers' Forecasts of Manpower Requirements: A Case Study* (Urbana, Ill.: University of Illinois, Bureau of Economics and Business Research, 1958), *Studies in Business Expectations and Planning*, No. 3.

³⁹ Albert N. Navas and others, op. cit., p. 2.

⁴⁰ See Eric W. Vetter, "How to Forecast Your Manpower Needs," *Nation's Business*, February 1964, pp. 102-105 ff.

⁴¹ Eric W. Vetter, *Manpower Planning for High Talent Personnel*.

⁴² Ibid.; see especially chs. 5, 6, and 7.

⁴³ See John W. Kendrick and Daniel Creamer, *Measuring Company Productivity: Handbook With Case Studies* (New York: National Industrial Conference Board, Inc., 1965), *Studies in Business Economics*, No. 89.

focus or approach.⁴⁴ But firms that use even fragmentary planning are finding it useful, and are increasingly moving toward more objective, integrated, systematic plans.⁴⁵

The Minnesota Model for Micro Forecasting

Planning is based on assumptions and judgments. Changes in products and marketing and in techniques of production and administration and labor turnover all suggest anticipated changes and needs in the human resources of an organization. Many of these changes take time and training, and future states must be estimated. It is important to specify the factors or variables that represent changes. In this study, the basic variables were related in a conceptual model.⁴⁶

A conceptual model is a set of variables with specified relationships among them; it is an abstract generalization of how the relevant data are presumed to be related. In figure 1, the arrows are intended to show the direction of specified and assumed relationship. The plus (+) and minus (-) signs denote increases or decreases. Thus, the relationship at the left of figure 1 may be read, "As product demand increases, manpower requirements will increase."

Relationships and variables other than those shown in figure 1 could have been assumed, of course. This particular conceptual schema was adopted because: (1) It represents variables and relationships found in most operational micro manpower systems, (2) it can be tested, and (3) it represents a sufficiently comprehensive partial micro manpower system to be useful in research.

In the model, the dependent variable, *manpower requirements*, is defined as the number of replacements and additional employees needed, and is expressed in terms of occupation or skill level. The independent variable, *product demand*, is estimated by forecasting

sales or by forecasting workloads. It includes all goods, services, and activities performed or produced within the employing unit. The relationship between product demand and manpower requirements is assumed to be positive.

Relationships between product demand and manpower requirements are influenced by the following intervening variables: Changed efficiency, expansion of facilities and services, financial resources, external labor supplies, and internal labor supplies.

Efficiency refers to technological and administrative changes which change labor productivity, consequently affecting manpower requirements per unit of output. In some instances, technological and administrative changes will increase the demand for certain occupational groups, but manpower requirements generally will be lowered as efficiency improves. It is also hypothesized that increases in efficiency which lead to price reductions will result in increases in sales and, consequently, in manpower requirements. The net effect of increased efficiency depends largely on the price elasticity of product demand and on the magnitude of the increase in labor productivity. Increased efficiency is expected to increase financial resources.

The next intervening variable, *expansion*, includes facilities expansion and new products. Expansion affects product demand and also may have an impact on the relationship between product demand and manpower requirements. The nature of this impact has not been specified because it is probably specific to each situation.

Internal labor supplies include both the quality or skills of an organization's labor force and the number of employees. The former is estimated by skills inventories and forecasts of employee development and the latter by turnover figures. As indicated in figure 1, it is assumed that, as the internal labor supplies increase, manpower requirements for given levels of product demand will be reduced.

Increased financial resources are assumed to have a positive impact on internal labor supplies, external labor supplies, expansion, and efficiency. As financial resources increase, more training can be given to the current labor force, thus increasing the quality of labor. Higher wages can be paid, which will tend to reduce separations and increase the external supply of labor. More financial resources also facilitate capital investment.

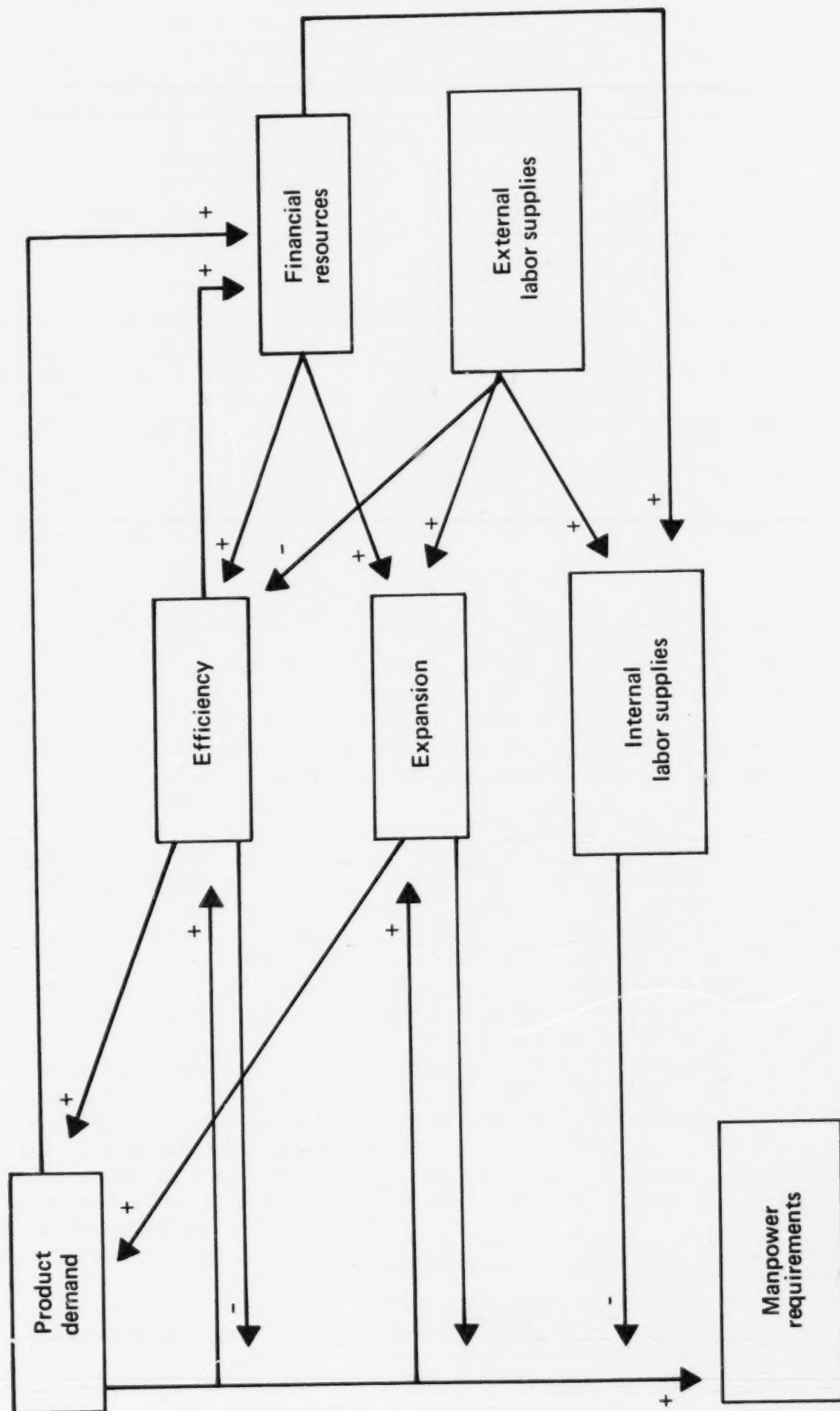
The last intervening variable in the primitive model is *external labor supplies*, defined as the manpower, by occupation or skill level, available to the firm from its various labor markets. As indicated earlier, it is assumed that external supply can be manipulated by varying wage

⁴⁴ Edwin B. Geisler, *Manpower Planning: An Emerging Staff Function* (New York: American Management Association, 1967), A.M.A. Bulletin No. 101.

⁴⁵ Cf. Arthur W. Saltzman, "Manpower Planning in Private Industry," in Arnold R. Weber, Frank A. Cassell, and Woodrow L. Ginsburg, op. cit., pp. 79-100.

⁴⁶ We are grateful to our colleagues George Milkovich, Paul Nystrom, and Tim Keaveny for their conceptualization of this model. See George Milkovich and Paul Nystrom, "Manpower Planning and Interdisciplinary Methodologies," *Manpower and Applied Psychology*, Winter 1968, pp. 17-21; also available as University of Minnesota, Industrial Relations Center Reprint No. 63, 1969.

FIGURE 1.
A MODEL OF MANPOWER FORECASTING.



rates.⁴⁷ It is also postulated that large external labor supplies of the type currently used by an organization will restrict the introduction of labor-saving innovations, but will increase the likelihood of expansion (assuming sufficient product demand), and will be positively related to financial resources. The last relationship assumes that, if an excess external labor supply exists, labor costs will be less than would otherwise be the case. On the basis of evidence indicating an inverse relationship between separation rates and unemployment rates, it is hypothesized that, as the external labor supply increases, the internal labor supply

⁴⁷ The degree to which the external supply of labor for certain occupations can be influenced by manipulating wages is limited in the short run. The hypothesized relationship assumes that individuals with the required skills are unemployed, can be attracted from other firms and geographic areas, or can be drawn into the labor force. If the particular skills are in short supply

will also increase because of a reduction in separation rates.⁴⁸

The independent variable, *product demand*, is assumed to have a positive impact on several of the intervening variables. It is predicted that, as product demand increases, pressures for increases in efficiency are greater, the likelihood of product line and facilities expansion increases, and financial resources become larger.

In the preceding discussion, financial resources and external supplies of labor are assumed to be variables which individual firms can manipulate. In practice, some firms may prefer to view them as variables, while others view them as constraints or given factors.

and a long training period is necessary to develop them, increasing wage offers probably will not markedly influence the short-run external labor supply.

⁴⁸ Herbert S. Parnes, *Research on Labor Mobility: An Appraisal of Research Findings in the United States* (New York: Social Science Research Council, 1954), pp. 135-138.

THE MINNESOTA FORECAST SURVEY

To provide insights into problems of manpower planning and forecasting, the authors conducted a pilot survey of the extent and nature of manpower planning and forecasting by firms, with emphasis on techniques of forecasting and factors considered. The survey sample was composed of most Minnesota organizations employing 500 or more workers.⁴⁹ (See table 1.) A mail questionnaire provided an overview of the respondents' manpower forecasting techniques, and personal interviews were arranged with firms that reported use of a unique or relatively sophisticated approach to manpower forecasting. Of the 105 employers sent questionnaires, 69 returned usable replies and 25 were interviewed.

TABLE 1. SIZE OF REPORTING UNITS¹

Type of industry	No. of units	Average No. of employees	Median No. of employees
Manufacturing	43	7,917	1,500
Nonmanufacturing	26	3,303	1,650
All reporting units	69	6,178	1,500

¹ Replies for some organizations referred only to a plant or a division and therefore the term "reporting units" is used instead of firm or company.

Out of the 69 respondents, 50 (or 72 percent) forecast all or some part of their manpower requirements. Such forecasts were more prevalent among nonmanufacturing than manufacturing firms (81 versus 67 percent) and

⁴⁹ Since the sample was not selected on a purely random basis, the results must be viewed as tentative and suggestive.

among large than small firms (87 percent of those with over 5,000 employees but only 50 percent of those with under 1,000 employees). Surprisingly, only 36 percent of all responding firms forecast manpower supplies—and an even smaller proportion of manufacturing units did so. There was some overlap between the firms forecasting requirements and those forecasting supplies, but 8 percent forecast only supplies and 43 percent only requirements. The most common explanation for not forecasting manpower requirements was stable labor demand and supply, reported by nine firms.

The other principal findings which follow are based primarily on the questionnaire returns of the 50 respondents who forecast manpower requirements. (For some items, the number of responses is less than 50.) Those based on the 25 interviews are so designated.

Administrative Arrangements

In 44 percent of the firms, the personnel department prepared the forecasts of requirements. The larger the firm, the less the likelihood that the personnel department would make the forecast. Forecasting was less likely to be done by the personnel department in manufacturing (38 percent) than in nonmanufacturing firms (52 percent). Whoever made the forecasts, managers and foremen were consulted on needs in 90 percent of the cases.

Forecasting activities had begun within the past 5 years in 59 percent of the firms. Nearly one-fifth of the firms had started forecasting no more than 1 year before the survey.

Only 29 percent of the firms prepared their forecasts more often than once a year. Those in manufacturing

were somewhat more likely than nonmanufacturing concerns to be in this category.

One- and 5-year forecasts were most common, each accounting for 44 percent of the firms. With few exceptions, the other firms forecast for periods between 1 and 5 years and also made 1-year forecasts.

Only about one-third of the reporting units forecast requirements for all employees. Another fifth—predominantly in nonmanufacturing—forecast only for managerial and administrative personnel. Managerial and professional requirements were reported to be the most difficult to forecast (cited by 31 firms).

Factors Considered

Sales were the only factor considered by over half of the respondents that forecast requirements. At least a third of the firms reported taking account of only three other elements—workload, facilities expansion, and quality of internal labor supplies. Surprisingly, less than one-fifth of the firms considered technological and administrative changes *per se*. Perhaps some firms indirectly took account of technological changes in considering facilities expansion and the addition of new products. The last-named factor was considered only by manufacturing firms, but nearly twice as many non-manufacturing as manufacturing firms considered both facilities expansion and technological change. The frequency with which organizations gave consideration to these and other factors in forecasting requirements is shown in figure 2, which describes the operational meaning of each variable in the Minnesota Micro Model.

Two elements not shown were reported by a small number of firms. Fifteen percent took account of company plans and objectives, and 20 percent used forecasts by other organizations in making their own forecasts.

Uses of Manpower Forecasts

About 9 out of 10 firms used forecasts for recruiting, but only about 1 out of 3 related manpower forecasts to budget plans, training, or transfer and promotion programs. Only 1 out of 10 used the forecasts in plans for production, space, and facilities, and their use in plans

for acquisition and expansion or in product pricing was reported even less frequently.

In brief, manpower forecasting seemed to be almost completely isolated from other types of planning. Some 95 percent of the survey firms forecast needs for equipment, 90 percent for capital, 80 percent for plant, and 66 percent for raw materials.

Accuracy of Forecasts and Response to Errors

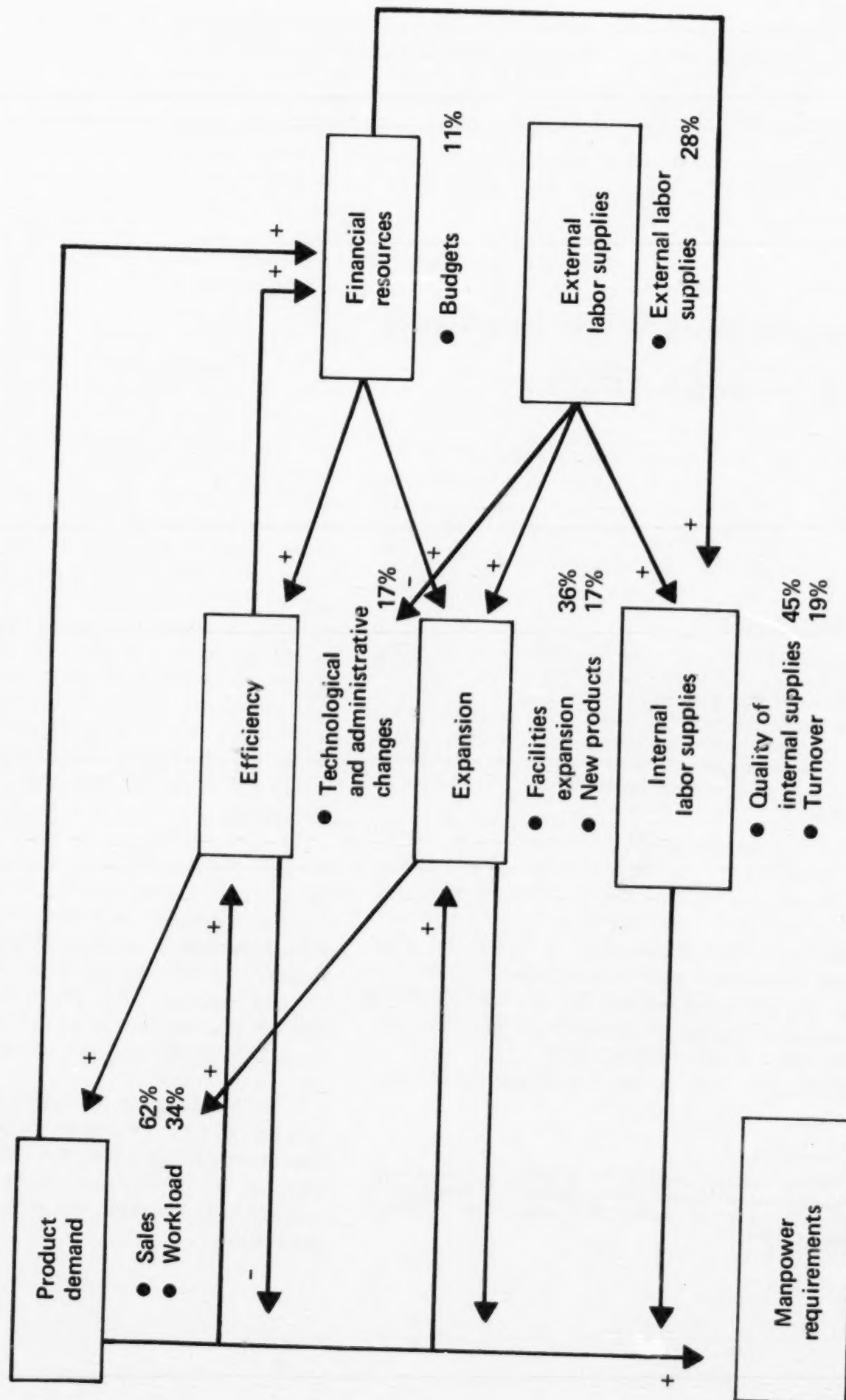
When forecasts go wrong, most of the firms follow a "put out the fire" approach. Almost 9 out of 10 adjusted manpower to both underestimates and overestimates. The preponderant response to underestimates was to accelerate hiring, and about 1 out of 5 expanded overtime and the same proportion used recalls. When they overestimated, about two-fifths slowed or stopped hiring, nearly as many made layoffs, and about one-fifth depended on attrition. Only about 5 percent attempted transfers or stopped overtime.

For more accurate forecasting, between one-sixth and one-fourth of the reporting units said they needed more information about company plans and objectives; sales and production forecasts; internal and external labor supplies; and anticipated technical, administrative, and organizational changes. Employment records by occupation are, of course, crucial to good forecasting. Yet 20 percent of the manufacturing firms had no occupational breakdown on employment, 30 percent had none on separations and hires, and 60 percent had none on age. In nonmanufacturing, the pattern was similar, but the percentages were smaller.

Among the 25 firms with the most complete forecasting systems, only three tested the accuracy of their estimates. Most felt that the 1- or 2-year forecasts were accurate within 5 to 10 percent and the 3- to 5-year forecasts within 15 to 25 percent. Thus, forecasting seemed merely an "exercise" in many firms. On the other hand, some firms built spurious accuracy into their forecasts by using them as the basis for controls over hiring and wage and salary payments.

Thirty-four of the firms in this survey had participated in the Area Skills Survey by the Minnesota Department of Employment Security in 1963. Comparison of their 2-year estimates from that survey against actual employment for 1965 showed a median error of estimation of about 5 percent. Nearly two-thirds of the firms with larger errors prepared formal manpower forecasts, but

FIGURE 2.
OPERATIONAL MODEL: VARIABLES USED BY SURVEY FIRMS.



only one-third of those with smaller errors did so. However, considering only those firms that experienced above-average changes in employment, forecasts were prepared by four-fifths of those with low estimating errors, but by only one-fifth of those with high errors. Hence, it appears that formal manpower forecasting is superior to "naive" estimates only when employment changes substantially.

Comparison With Findings of Milwaukee Survey

While there are no surveys directly comparable to the Minnesota survey, Richard Perlman made a somewhat similar study of 159 Milwaukee firms in the spring and summer of 1966.⁵⁰ Almost all of those responding had more than 100 employees, and almost two-thirds reported that they did some manpower forecasting. Perlman concluded:

Unfortunately the study yields very negative results on the extent or quality of manpower forecasting. While most firms report that they engage in manpower forecasting to some degree, by the criteria established they do not tend to forecast seriously, even though they claim that poor forecasts would harm their operations. Further, the extent of forecasting does not appear closely related to training programs which the respondents undertake.⁵¹

He found that the likelihood of forecasting was not related to size of firm or type of production process (continuous or discontinuous). Respondents were, however, more likely than were other firms to forecast manpower if they forecast sales, if they would suffer greater losses in efficiency through failure to provide for their own manpower needs, if they had formal training programs, or if they were branch plants (rather than home offices or self-contained units).

Of the 159 firms studied, 24 forecast overall man-

power requirements, 45 forecast for particular jobs, and 34 for both overall and particular needs. Firms which classified themselves as "accurate" in their forecasts were more likely to make detailed forecasts.

Only a few firms used objective variables other than "estimated" manpower requirements in forecasting. Perlman judged the "seriousness" of their forecasts by the type of additional variables used. In the order of importance, the "serious" variables were: Man-hour figures derived from sales forecasts; sales forecasts from past experience; attrition rates; and changes in separation and retirement rates. Altogether, 30 percent of the firms that made manpower forecasts used "serious" methods. He classified as less serious or not serious the use of estimates of the number of men needed; judgment based on expectations; conversion of sales to man-hours; ratio of employees to equipment; ratio of assets to employees; amount of business; and (tied for last place and seldom used) ratio of sales dollar, "based on expansion," and "informed by central office."

Most firms, especially those using serious methods, forecast requirements for 1 year or a longer period. Revisions of the forecasts were made quarterly, semi-annually, or annually by about half the firms; daily, weekly, or monthly by about one-fifth; and either "as necessary" or not at all by the remainder.

As to who does the forecasts, the replies in the order of frequency were: Production and sales departments; production department; vice president; and personnel department. Only one firm had a special forecasting department.

The firm most likely to forecast accurately made forecasts for specific occupations, forecast for long periods and changed forecasts relatively infrequently, and would have serious staffing problems as a result of forecasting errors (especially underestimates). The "seriousness" of forecasting method was *not* related to accuracy. Accuracy was measured by comparing the forecast with actual employment, the number of man-hours needed, ability to get the work out, and "intuition," in that order.

As in the Minnesota survey, the outstanding impression obtained from Perlman's study is the variability in forecasting practice among firms. Underlying this variability is the finding that much experimentation is underway. At this stage, this is inescapable, necessary, and healthy.

⁵⁰Richard Perlman, *Assessing the Extent of Manpower Forecasting Among Milwaukee Firms* (Milwaukee: University of Wisconsin, Center for Studies in Vocational and Technical Education, 1968).

⁵¹*Ibid.*, p. 2.

CASE EXAMPLES FROM THE MINNESOTA SURVEY

The exploratory probe uncovered the general nature and extent of manpower planning policies and practices among the firms included in the Minnesota survey. But general results do not give a "feel" of how manpower planning is done in individual employing units. In this section, 11 examples from the survey will be used to illustrate various practical aspects of manpower planning; the point of emphasis for each case is indicated in the case heading.

Case A: Fixed v. Variable Labor Requirements

This organization is a research laboratory and manufacturing facility with more than 2,500 employees. The parent organization is a major developer and manufacturer of electronic data processing equipment. In the opinion of the staff who made the survey, the forecasting techniques of this organization are the most sophisticated ones surveyed.

The manpower forecasting activities in this employing unit are the responsibility of the planning department, whose functions also include forecasting new products and space allocation. Manpower forecasting is an integral part of the entire planning cycle, which runs for 2 years. Five-year projections are also calculated and used by the company to provide long-range direction.

The planning department reports to the assistant general manager, who, in turn, reports to the organization's general manager. The manpower forecasting responsibilities are divided between two individuals. One

forecasts "direct" manpower (those directly involved in production); the other, "indirect" manpower (support personnel).

The "direct" forecast uses the following types of input:

Schedules and loads: Announced production schedule; developmental production schedule; special requests for customer specified modifications; inplant load of out-plant requirements; behind schedule load; and proposed resourcing load (subcontracting to vendors).

Inplant manufacturing hours by machine (product) type: Dynamic program estimate (time estimate to complete production); cost target hours (a target or ceiling for the cost of the man-hours required for the production); and prototypes—an estimate of the cost of producing new unmarketed products for testing.

Other factors: Performance (expressed as a percent of the standard time necessary to complete the production of a unit by an individual); utilization—percent of man-hours spent on direct production, in recreation, etc.; on time lost because of sickness or accident and for personal reasons, and on vacations and holidays; the learning time or manufacturing time curve for a product; and unmeasured hours (time that is typically unaccounted for), used as an index of the thoroughness of the planning model and the department.

These data are used to forecast the direct workload (number of employees) required for each department and function, by man for 3 years; by machine, sub-assembly, final assembly, and quality control; by machine type; and by product family.

The calculations are performed on a computer.

In forecasting, indirect manpower is grouped into variable and fixed manpower. Variable manpower is further divided into plant manpower not related to any

one product but whose workload varies with total plant manpower, and functional manpower whose load varies with the plant's functions and product mix. Fixed manpower is made up of "hard-core" employees, or those not affected by workload in the plant or function, and "management assigned" employees, or those performing desired services in jobs established by management.

The key to forecasting indirect manpower needs is a "manning table" showing indirect employees by name and department, baseload, projected load, and "elements." Elements are the activities or actions that comprise the employee's job duties. Baseload is the typical or average number of these actions (elements) taken in a base period (normally 1 month). Projected load is the number of actions expected to be necessary in the future (every month for 2 years). The projected load is based mainly on the information provided in the "schedules and loads" portion of inputs to the direct manpower forecasts.

Each functional manager is asked to decide what percent of each subordinate's time is spent on each element. In the sample manning table shown in figure 3, John Doe spends 40 percent of his time on the element "purchased part numbers," and the baseload was 800. This relationship resulted in a conversion factor of .0005 (proportion of his time spent on each unit). The projected load of 1,600 "purchased part numbers" is multiplied by the conversion factor to get the number of men required for the projected load. Considering the other two elements of John Doe's job and the projected load, the planner arrives at a total of 1.58 employees required for the workload. Either John Doe will have to work substantial overtime or new help will have to be brought in or some work subcontracted out.

This same procedure is followed for each individual employee and the results summed to get projections of total indirect manpower requirements for each department and function and the entire company. The projected requirement is compared with the total currently employed, and various strategies, such as subcontracting work, part-time work, and overtime work, are suggested to reconcile the difference.

The results of both the direct and indirect projections are combined and presented to a "workload committee," which meets every 2 weeks or "by request." The committee is made up of the general manager, the functional managers, and representatives of the planning department. The result of the meeting is manpower ceilings or available manpower for each function. Variations in the workload are handled by various strategies such as subcontracting to vendors during peaks and pulling back contracts during valleys.

When asked how it handled technological change, the company cited the frequency with which it updated its projections (monthly or by request). For example, it was not exceptional to get a request at any time for a manpower projection for an entire plant or new product line. In other words, this company has reached the degree of sophistication of *simulating* various product lines and plant facilities on the computer before any action is taken.

The outputs from the direct and indirect projections are sent to the functional managers who use them as a guide to their operations.

Little was done on the supply side with the interesting exception that, because of the shortage of skilled tradesmen in the area and the projection of increasing needs, the firm has started hiring and training unskilled workers. The firm indicated it could break down the projections by other skill groupings in addition to direct and indirect manpower, but that further mechanization is necessary to do the job economically.

Accountability for the accuracy of the estimates rests with the planning department, but since the projections become the standard and guide for operating departments, they provide extremely accurate inputs. When asked if managers attempt to beat the "system," the response was "not too often," since they are convinced that accurate planning is a tremendous aid in their decision process. The projections are generally within 2 or 3 percent of the number of men required. Accuracy was considered to be completely dependent on the accuracy of the projected production schedules.

Case B: Total Organizational Planning

This case concerns a division of a large corporation whose sales in 1967 exceeded \$1.25 billion and whose employment exceeded 100,000. The division discussed here produces and services data processing equipment. Its employment in 1967 was 7,900, with a relatively large proportion of technical and managerial personnel.

The special aspect of this case is the emphasis on relating manpower forecasting and planning to other aspects of corporate forecasting and planning. A second interesting feature is that plans are prepared for meeting the forecast manpower requirements. This firm was one of the few respondents in our study reporting the opinion that product and technological changes have a significant impact on their manpower requirements—not

FIGURE 3. SAMPLE MANNING TABLE.

DOE, JOHN 834621 355

Base load

Manning factor	07	10	11	
Percent of time	40	40	20	

Projected load

Manning factor				
Percent of time				

Percent must equal 100

Not in indirect manpower ceiling:

Function no.: 8

Functions	
Administration	0 Plant engineering
Manufacturing	1 Personnel
Manufacturing engineering	2 Production control
Quality control	3 Purchasing
Controller (finance)	4 Systems
	5
	6
	7
	8
	9

Factor code	Element	Percent of time	Number of actions	Conversion factor	Projected load	Men required
07	Purchased part number	40	800	.0005	1,600	.80
10	Purchase orders	40	800	.0005	1,000	.50
11	Operational subcontract	20	50	.0040	70	.28
	Total	100				1.58

merely on the number but, significantly, on the skill mix.

At the time of the survey manpower forecasting activities had been carried on for the past 5 years. Forecasts are prepared semiannually for all employees for each of the next 5 years. In the 1- and 5-year forecasts, needs are specified by location and by the following employee categories: professional, managerial and administrative, technical, clerical, and factory. These forecasts indicate whether the manpower needs will result from separations, expansion of current activities, or from new activities. The 1-year forecast of professional manpower requirements specifies the number of employees with each of seven different degrees needed, the number who can be new college graduates, and the number who require experience of specified amounts and types.

The operating departments prepare forecasts of their manpower needs and the personnel department makes forecasts for the entire division. The forecasts are based on information pertaining to business prospects and changes in products which affect manpower needs and on separation rates.

The two manpower forecasts are reported at semi-annual planning meetings of division officers and department heads. Any discrepancies between the sum of the department forecasts and the forecast for the entire division are ironed out at these meetings. Once a manpower forecast is agreed upon, it must be reconciled with plans for facilities, finances, and budget; market forecasts; and revenue goals. Each aspect of the division's plans must relate reasonably to all other types of plans and expectations.

The director of industrial relations prepares a plan to meet the 1-year manpower forecast. This plan estimates the number of positions, by employee category, which can be filled internally through transfer, promotion, and training; and the number which must be filled through recruiting. The training plan indicates the number of individuals to be trained, the type or content of training, and the method of training (such as university or company course, job rotation, or coaching). The anticipated costs of training and recruiting are specified in the manpower plan.

This firm is unique among responding companies in that it views manpower supply as a constraint affecting manpower planning and other phases of planning. For example, plans for expansion may be delayed or revised because labor of the required type is not available. Almost all other respondents took the position that manpower supply was not a limiting factor; they felt it would be adequate regardless of how much labor was

required and need not be considered in estimating labor requirements.

The manpower forecasts and plans which result from the planning meetings are reported to the vice president, the general manager, and the president of the corporation. The forecasts and plans are used in planning budgets, training, transfers, promotions, and recruiting. In addition, these forecasts and plans are used for planning at the corporate level. A similar process of integrating the different divisions' forecasts and plans is carried on at the corporate level.

Case C: Forecasts of Labor Supplies

The techniques of projecting manpower requirements described in this case study were used by a major public utility, which employs over 10,000 people, most of whom are women.

The unique feature is the consideration given to external labor supply. Of the participants in this study, this one had by far the most comprehensive approach to projecting supply.

Projections of labor requirements had been prepared for over 10 years before the firm was surveyed. Forecasts of requirements for each of the next 12 months are prepared monthly; for the next year, quarterly; and for each of the next 5 years, annually.

The projections are for manpower needs by department. There are seven departments, each divided into divisions, which are subdivided into districts. The manpower forecasts are the responsibility of the district managers.

The following description outlines the forecasting process within one of the seven departments, whose districts are subdivided into units of 80 to 200 employees. The head of each unit prepares a forecast, based on the unit's workload, which is derived from the number of "work-units"⁵² being used and the rate of use. Identification of work-units completed per man-hour and the average time worked per employee enables the supervisor to estimate the unit's future manpower requirements. The district managers in this department compile the unit projections and forward them to the division heads, with a copy to the personnel department.

⁵² "Work-units" is used to avoid revealing the service provided, which would identify the company.

The district projections are reviewed by the State personnel supervisor. They are compared with industry data on units of work per man-hour. Summaries of the district projections are submitted to the division managers, the department supervisors, the general managers, and the vice presidents.

The stated purpose of manpower forecasting in this organization is to "initiate and sustain activities which will insure adequate numbers of qualified people are available and trained when and where they are needed to meet the company objectives." The following points summarize this organization's conception of the essential steps for manpower planning:

1. Identify what is to be done. How large are the workloads going to be?
2. Specify the standards to be met. What are the service and cost objectives?
3. Identify the current resources of the unit. What kinds and quality of equipment are available, and how adequate are both the number and the experience level or quality of the labor force?
4. Identify what additional resources will be needed. How many people will be needed and when? What equipment will be required and when?

Labor supply forecasts are prepared when local conditions indicate potential manpower problems such as difficulty in attracting job applicants. School registrations by grade provide information on future annual input to the labor market. Many other firms provide information about their future plans, such as anticipated rates of growth and location, which companies other than a public utility probably could not obtain. Transportation companies and the State Highway Department provide information which helps the company estimate the mobility of people. Studies of industrial growth and living patterns in the urban area and a close watch on the availability of desirable housing facilities for single persons located close to this company's locations aid in estimating the number of hires that can be expected from out-of-town sources.

The importance of forecasting labor supply is clear from this organization's experience. Projections of labor supply to 1975 indicate that one of this company's heavy service locations will not be able to hire enough personnel. The plans to meet this shortage include the introduction of more sophisticated equipment, which will increase the productivity of labor, and the establishment of work centers outside the heavy service area, in locations where the anticipated supply will be more favorable.

Case D: Correlation of Forecasts to Sales Dollars

This corporation is a widely diversified manufacturing company, with several product lines as well as various plants and offices in the United States and foreign countries. In 1967, it employed approximately 53,000 people.

The basis for projecting managerial and sales manpower requirements in this organization is a sales forecast—the most common device used by companies participating in this study. Although some respondents found the relationship between sales and manpower requirements to be rather weak, results in this company were quite satisfactory, with the error in 1-year manpower forecasts usually no more than 1 percent.

When the firm was surveyed, 1- and 5-year projections of manpower needs had been prepared for 14 years for five classifications of managers: Sales, laboratory, engineering, administration, and production. The forecasts are completed annually for the current year, and the 5-year forecast is updated.

Projecting needs for managers and salesmen is the responsibility of the director of employment. When this company initiated its manpower forecasting program, it was already doing other types of forecasting, all based on forecasts of sales dollars. Consequently, an attempt was made to identify the correlation between sales dollars and employment by management category. The controller's division provides sales data. Analysis of past performance indicated that while 1-year sales forecasts were quite accurate, longer forecasts were influenced by national economic variances. Consequently, manpower projections have been limited to 1 year for recruiting purposes.

For projecting managerial requirements, the total company sales forecast for each year is divided by the average sales per manager for the past 5 years. The resulting number of managers is adjusted for average turnover among managers for the past 5 years. A quarterly followup analysis of this technique indicates that the general forecast error has been less than 1 percent.

This approach formerly presented some difficulties in forecasting the need for salesmen. Since it takes from 6 to 9 months for a new salesman to become qualified, trainees must be hired well in advance of the time when they are expected to produce. A schedule for the regular addition of salesmen throughout the year was therefore

established, and when it was implemented, the forecasting techniques used were found to be as effective for salesmen as for the other categories.

The forecasts of manpower requirements are jointly submitted by the controller's division and the employment department to the vice president of personnel and industrial relations, to the president, and to the management committee.

This firm bases its recruiting plans on the forecasts, and total budgeted salary requirements of the operating and staff divisions are directly related to the forecasts.

Case E: Forecasting for Production Employees

This case summarizes forecasting techniques of a corporate division having 2,100 employees. The major component of this division's labor force is semiskilled production workers. At the time of the survey, manpower forecasting had been done for 5 years. Two manpower forecasts are prepared, one for production worker requirements and the other for total employment.

The forecast of *total employment* is prepared annually by the manager of manpower planning, working in conjunction with the corporate planning group. The forecast is for the coming 5 and 10 years. The inputs for this forecast are growth and new products. The forecast is submitted to corporate management for use in corporate planning.

The estimates of *production worker requirements* are prepared monthly and cover a 6-month period. The manager of manpower planning is responsible for these forecasts and bases them on sales projections, by product and model, for the next 6 months. Production control identifies the average daily rate of production by product necessary to meet the sales forecast. The manpower planner also estimates the internal labor supply for the next 6 months. This is done by adjusting the number of production workers currently employed for separations and time lost because of vacations.

If requirements exceed supply, three courses of action are considered: Expanding the work force; having the present labor force work overtime; and establishing production priorities. The first alternative is favored when there is a large increase in manpower requirements, but the recent tight labor market made large increases in employment impossible except during summer months. Overtime is favored for smaller increases in production; however, when used for periods in excess of 2 or 3

weeks, the efficiency of labor falls. In this division it is estimated that after employees have worked 10 hours a day for 2 or 3 weeks, their production in a 10-hour day is about equal to their normal production in an 8-hour day. The drop in efficiency is attributed to the heat in the production area. The final and least favored alternative is to produce those products needed immediately, and hope that less urgent demands can be met in the future.

When forecast supply exceeds forecast demand, attempts are made to sustain demand for manpower by producing for inventory. This organization feels that the intangible benefits stemming from steady employment for their regular work force justify such action. Workers are laid off only when producing for inventory is not feasible.

The forecasts of production worker requirements are submitted to the division's general manager, who may adjust them on the basis of information which is not available to the manager of manpower planning. As indicated above, the manpower forecasts are used for planning production schedules and for employment decisions. In addition, the manpower forecasts are considered in estimating future earnings of the division.

Case F: Forecasting for a White-Collar Firm

The subject of this case is a major life insurance company; in 1966 its assets were \$462 million and it had approximately 545 employees, largely clerical workers. One-year forecasts are prepared annually for clerical employees and exempt employees.

The department managers are primarily responsible for forecasting; the director of training is the controller and coordinator of forecasting. The clerical forecasts are based on "work measurement standards, work volume trends, and expansion plans." Work measurement standards are the key tasks or activities performed by a section, that is, the number of lines typed or the number of policies handled. A work measurement team studies the work within each department to determine key tasks or activities, using a work sampling method. Each key task or activity is assigned a weight based on the average man-hours necessary to complete the task, or some unit of the task, such as typing 100 lines. Work measurement standards are prepared for each section. The section supervisor and department manager estimate the volume of measured work required during the

coming year, based primarily on past experience, and on such anticipated deviations as acquiring a major new policy holder or converting part of the operation to electronic data processing. The projected measured work volume multiplied by the standard work measure provides an estimate of man-hours required. The man-hours required are converted to costs (salaries) by each department on the basis of projected salaries of present employees and of any new employees who may be required to handle the measured work volume.

Each department manager submits his "man-hours budget" to the training director for approval. The decision to approve or disapprove the man-hours budget is based on the cost per man-hour worked. When approved, the budgets are transmitted to the personnel manager and finally to the board of directors.

The forecasts, in effect, are budgets for the departments. If additional manpower is needed, the department can justify its requests on the basis of its projected work volume. The departments ask the personnel department to add employees to existing positions or to write descriptions for new positions and hire workers to fill them.

The forecasts of manpower requirements for exempt or support personnel are based on a ratio of support to line personnel. Currently, a ratio of about 1:10 is maintained for supervisory support personnel and similar ratios have been developed for technical, middle management, and top management support.

In this company forecasts are used in recruitment and selection, to control labor costs, and to plan space and facilities.

Case G: Manning Tables and Skill Inventories

This case study is of a bank, which in 1967 had assets exceeding \$550 million and approximately 650 employees. The majority of the labor force are clerical workers; the remainder are primarily managerial employees.

At the time of the survey manpower forecasting had been done by this bank for 10 years. Forecasts are prepared semiannually for top management, middle management, and clerical employees. The length of the forecast periods for these groups respectively are: Each year for 10 years, each year for 5 years, and 1 year.

The manpower forecasts are prepared by the vice

president in charge of personnel. They are used for manpower planning and budgeting. The factors considered in estimating future manpower requirements are anticipated new services, systems changes, growth, retirements, and other separations. An example of a systems change is the introduction of a computer to perform work formerly done by clerical employees. Information pertaining to these factors is forwarded to the personnel department by the department heads, the division managers, and the bank president.

Based on this information, estimates are made of the number required in each of the three employee groups at various times. A *manning table* is prepared for the top management group. This table indicates the number of present, additional, and total officers, by position, required by each division. In addition, the time and reason for each addition are indicated. A sample of the manning tables used by this organization is shown on p. 24. Reports of the forecasts are submitted to the bank president, division heads, auditor, and training director.

A special feature of this case is that *two skills inventories* are maintained to assist in manpower planning. One inventory lists the name, education, and job experience for each of about 80 employees who are members of middle management and are expected to progress to the top management level. The information about each employee is regularly updated. This skills inventory, coupled with the manning table, enables the personnel department to identify possible trouble spots. For example, will any present personnel be qualified to fill the top management vacancies expected to arise in 1971?

The second skills inventory is for clerical employees. Unlike the management inventory, it is not updated. When a person is first employed, his typing and shorthand speed and foreign language skills, and the results of his personality, vocabulary, numerical, and reasoning tests are placed on a card. Information has been gathered on requirements in these areas for various jobs, so that when vacancies occur, the personnel department can use the skills inventory to identify those employees capable of filling them.

Case H: Internal Labor Supplies

This case describes the forecasting techniques of a corporation which during 1967 employed 1,200 persons

MANNING TABLE FORM
Estimated Officer Requirements, January 1966 Through December 1975¹

Position	Present number of officers	Officers to be hired										Reason for hiring	Anticipated number of officers, 1975
		1966	1967	1968	1969	1970	1971	1972	1973	1974	1975		
Senior vice president	2	1									1	Retirements	2
Vice president	8	1			1	1					1	- do -	8
Assistant vice president . . .	3						1		2	1		Retirements and growth	4
Assistant cashier	11		1						1			- do -	12
Junior officer	34	3	2	3	2		2			2		Growth	48
Total	58	5	3	3	3	1	3	0	3	3	2		74

¹ Names of incumbents and functions, shown on the company's manning table, have been omitted to preserve confidentiality.

in its seven American operations. In 1966 its assets exceeded \$11 million and its sales exceeded \$28 million. It supplies fabricated metal products to the manufacturers of construction trucks and agricultural equipment. The majority of its labor force is made up of semiskilled production workers. The other principal groups are technical, clerical, sales, and managerial employees.

The noteworthy aspects of this case are the means by which internal labor supply is considered in meeting future manpower requirements, use of a manning table, and relation of manpower requirements to the overall corporate plan.

When surveyed, this organization had been forecasting labor needs for 3 years. Requirements for six categories of exempt employees are estimated for each of the next 5 years. The firm's employee categories are: Engineers and personnel requiring a technical degree; managers requiring a technical degree; managers not requiring a technical degree; sales; jobs requiring technical training but no degree; and all others (such as finance and marketing). The 5-year manpower forecasts are prepared annually.

First, a 5-year corporate plan is prepared by a management committee made up of the company president and the division managers for finance, research and development, personnel, production, and sales and engineering. Factors included in the plan are sales forecasts, financial objectives, production plans, marketing plans, research and development plans, and estimates of technological threats to present production lines.

The division managers then prepare manpower forecasts on the basis of the divisions' objectives as specified by the corporate plan. Each division manager consults the managers reporting to him in order to estimate the exempt personnel required to meet divisional objectives.

Each division manager submits a forecast to the personnel department, indicating the job titles of the additional personnel required and the time when each position should be filled. He also indicates if the job should be filled internally and if he has a preference for a particular internal candidate. The form used for this report appears on p. 25. The personnel department consolidates the division forecasts and adjusts the estimates for turnover. The resulting report is presented in the form of a manning table. The sample table on p. 25 indicates the form of the manning table and the assumptions regarding turnover.

The manning table is submitted to the management committee. The summary manpower forecast is used by the committee to estimate the feasibility of attaining the objectives specified by the corporate plan. For example, the firm could possibly lack the funds or capability necessary to hire the required manpower; consequently, the objectives might have to be changed. In addition to being used in corporate planning, the manpower forecast serves as the basis for the personnel department's employee development and recruiting plan.

Case I: Small Firm—High Ratio of Technical Work

The manpower forecasting techniques of a corporation whose principal products are instruments for industry are described in this case. It employs about 700 persons, its assets exceed \$3.5 million, and its sales are approximately \$10 million. Sales have increased four times since

MANPOWER FORECASTING FORM
Fiscal 1968 Through Fiscal 1972

- ☐ - Indicates must be filled internally
☐ - Indicates strong preference for internal candidate

Division:
Department:
Prepared by:
Date:

Job title, specialty, or function	Fiscal 1968				Fiscal 1969	Fiscal 1970	Fiscal 1971	Fiscal 1972	Total
	1st quarter	2d quarter	3rd quarter	4th quarter					
Senior research engineer			①		1			1	2
Research engineer						1			2
Project engineer		1			1		2		4

MANNING TABLE FORM
Manpower Summary
Estimated Requirements, Fiscal 1968 Through Fiscal 1972
Salaried Employees Only

	Fiscal 1968				Fiscal 1968 total	Fiscal 1969	Fiscal 1970	Fiscal 1971	Fiscal 1972	Total fiscal 1968 through fiscal 1972
	1st qtr.	2d qtr.	3rd qtr.	4th qtr.						
I. Additional exempt personnel required										
A. Engineers and personnel requiring a technical degree										
B. Managers/supervisors requiring a technical degree										
C. Managers/supervisors not requiring a technical degree										
D. Sales (sales engineer or account executive)										
E. Jobs requiring engineering-type technical training but no degree										
F. All others (finance, production control, etc., not included in categories A through E)										
Totals										
II. Additional nonexempt personnel required										
All categories ¹										
III. Turnover										
Exempt replacements required for all locations except hyd. and overseas ²										
Nonexempt replacements required at general office ³										
IV. Combined totals										
Total estimated hiring effort for all general office salaried plus exempt salaried at branches ⁴										
V. Total general office salaried employment										

¹Based on ratio of nonexempt new jobs authorized versus exempt new jobs authorized for 3-year period ending June 1, 1967.

²Based on 0.5 percent turnover per month.

³Based on 2.0 percent turnover per month.

⁴Not included in any of these figures are 14 exempt and five nonexempt current authorized personnel openings.

1960. Twenty percent of those employed by this organization have technical degrees.

The organization's forecasting techniques present several interesting features: Forecasting for a *range* of manpower needs; forecasting for transfers, and for research and development personnel; and forecasting effects of technological change on manpower requirements.

Manpower forecasts were first prepared 1 year before the survey. Two manpower forecasts are prepared annually. A forecast of *total employment* needs for each of the next 5 years, relating employment to sales, is prepared by vice presidents and division managers. Sales are the crucial factor in projecting employment; it is anticipated that employment will increase at the same rate as sales. The forecast is presented graphically and shows estimates of the most probable increase in sales and employment, and the reasonable maximum and minimum rates of growth. For example, if a 25-percent increase per year represents the reasonable maximum and a 15-percent increase the reasonable minimum, a 20-percent increase would be considered the most probable rate of growth.

The total employment forecast is used in financial and building planning and, to some extent, in recruitment planning. Recruiting plans are not based entirely on this forecast because better short-range information for recruitment purposes is forthcoming from the second manpower forecast, described below. The 5-year forecast provides only a rough guide for planning and can be quite inaccurate. The inaccuracy stems from top management's policy of seeking out those product areas in which the organization can be the industry leader, and placing great emphasis on research and development. Hence technological change has a significant impact on the composition and level of manpower requirements. Because this organization seeks to be a leader in its product fields, it cannot look to what the leaders are doing to see what impact changes will have.

The second manpower forecast, also prepared annually, estimates *departmental manpower* requirements for six employee categories: Engineers, other exempt employees, assemblers, technicians, clerical workers, and other nonexempt employees. The forecast period is 1 year.

Each department manager prepares a manpower forecast based on sales forecasts and forwards it to the secretary-treasurer and to the personnel manager. A noteworthy aspect of this manpower forecast is that the department manager indicates either: (1) The number of additional workers needed, by employee type and, for exempt employees, by education and experience, and when they will be needed, or (2) if appropriate, the

excess number on the rolls and when they will be available for transfer. With this information, the personnel department can coordinate transfers between departments which are expanding and those which are overstaffed. The departmental manpower forecasts are used by the personnel department for planning recruiting efforts and by the treasurer for financial planning.

A special feature of manpower forecasting in this organization is its approach to projections for research and development personnel. For other personnel, manpower projections are a function of sales. In research and development, requirements are based partly on sales but also on probable payoff of a particular research project. Each project is rated from 1.0 ("can't miss") to 0.0 ("no possible payoff"). Employment outside research and development will always be positively related to sales. However, depending on the project ratings, employment in research and development could be inversely related to sales.

Case J: Wide Short-Term Fluctuations in Manpower Needs

This case concerns a retail catalog house which normally employs 1,500 people and services a seven-State region. The parent company is one of the largest such businesses in the world. The labor force of the catalog house is composed mainly of clerical employees and materials-handling workers.

The manpower forecasting techniques of this organization are included among the case studies because it experiences wide fluctuations in employment annually and specifies alternatives to be used to meet forecast requirements.

Manpower forecasts have been prepared at this location for 30 years for two groups of employees, merchandise handlers and management trainees. Both forecasts are made once a year in August. The projection for management trainees covers the upcoming 2 years and that for materials handlers the next 4 months, which span the peak business periods (back-to-school and Christmas) and inventory taking. The work force normally doubles (to 3,000) during the fall volume period. The organization "dies" in mid-December and then hires workers with a different variety of skills for the post-Christmas returns and reconditioning.

Manpower forecasting is an integral part of the overall budgeting cycle. The manpower estimates are based upon gross sales forecasts. Sales estimates are based upon 10-year sales patterns and trends, catalog items, planned discount promotions, and weather trends. Gross sales forecasts and order volume estimates are provided for the first-line supervisors.

First-line supervisors maintain detailed data on dollar budgets, sales, and volume of orders handled. Scheduling supervisors (one per catalog house floor) review these data for the past 5-year period and then submit their budget and manpower forecasts of materials handlers for hierarchical review and consolidation. The manpower forecasts are made separately for about 50 job titles. Final review of manpower estimates is made by the catalog house's general manager and personnel manager, but the budget is ultimately submitted to corporate headquarters for approval.

Accountability for the accuracy of estimates rests with the supervisors. A computerized report informs supervisors daily of hours worked, average daily wage rate, actual versus budgeted payroll plus variance in both dollars and percentage, and the supervisor's current performance index (based upon 1.00 as being on target).

Forecasting for management employees provides the foundation for a 5-year management development plan, although the forecasts for management trainees cover only 2 years. This forecasting is based upon such variables as age, promotions, performance, retirements and career paths.

If an underforecast of the need for wage employees occurs, the following actions are taken to expand employment: Advertising, hiring part-time help, recalling former employees, authorizing overtime, conducting special short-course training, and utilizing job dilution. An example of dilution is the breaking down of an order filler checker job into separate positions in which one woman fills orders, a second checks these orders, and a third wraps them. The organization adamantly refuses to lower hiring standards. Instead, it attempts to meet its manpower needs through special recruiting in high schools, offering cash awards to present employees for recommending the firm to friends who are hired, and inserting recruitment literature in credit mailings.

When the personnel manager was asked about the accuracy of the manpower forecasts, he responded that they are as accurate as the sales forecasts. This organization has detailed data to derive manpower requirements from workload measures. Demand for labor is derived from a product demand which fluctuates because of uncertain elements such as consumer preferences and the weather.

Case K: Relating 1-Year Forecasts to Workloads

This case concerns a division of a nationwide insurance company specializing in life and health insurance and pension plans. Total income of this organization in 1966 exceeded \$107 million; employment in 1967 was approximately 480. The division described in this case handles group insurance and employs 130 persons. Clerical employees are the major occupational group. The techniques described here also characterize manpower forecasting in the other divisions of the company.

This case exemplifies refined techniques of work control and transfers from one department and division to another in response to short-term fluctuations in labor demand.

Manpower forecasts had been prepared for 2 years before the survey. The forecast of total employment, prepared annually for each of the next 5 years, is the responsibility of the division manager and is based on a sales forecast. The latter was described in the interviews as a "seat of the pants" judgment on the part of the top division management. The forecasts of sales and employment are submitted to top company officials.

In addition to the longer run forecasts, a more precise 1-year projection of total employment is made annually. Each department within the division submits a projection of workload, manpower needs, and expenses to the division manager. He then prepares a division projection of these elements for the controller, who, in turn, submits forecasts to the company president.

Each departmental projection includes a list of projects for the coming year, with planned beginning and completion dates; a projection of manpower requirements for the coming year on a monthly basis; a projected salary budget for the coming year on a monthly and on a cumulative basis; a graph indicating historical department salary costs; and a cross-training chart showing each job and each employee in the department, and the jobs in the department for which each person is trained. The division forecast contains the same information but deletes project dates and limits the cross-training chart to key personnel.

To project employment, each department starts with a least squares projection of workload trend, measured by number of applications for insurance. This projection is multiplied by the man-hours required per unit of work to derive the number of man-hours required. This figure is adjusted to specify the man-hours required per week and to allow time for training new employees and

cross-training current employees. The adjusted number of man-hours per week is divided by the average number of hours worked each week per employee to estimate the number of employees required.

These manpower forecasts aid in planning recruitment, selection, promotions, and transfers. The cross-training information makes it relatively easy to arrange transfers between departments and divisions in the event of an underestimate or overestimate of labor requirements. However, the primary uses of cross-training information are to control workloads, employment, labor costs, and training. Each month the department managers report progress on projects, comparisons of projected and actual employment and salaries, and changes in cross-training to the division manager. Reports containing similar information are prepared quarterly by the division manager for the controller.

Summary of Cases

These cases represent samples of programs actually used by employers in the pilot survey. They are descriptive, not representative in the statistical sampling sense, and essentially snapshot rather than longitudinal. They seem to show that micro manpower planning is in its infancy. A wide spectrum of approaches and techniques is found among the firms—no one firm uses all the techniques. Most firms in the survey emphasize partial manpower forecasting and engage in only limited overall manpower planning, but appear to be improving their micro manpower planning capabilities and achievements. From their experiences some prevailing major problems may be indicated with some guidelines that may help in future efforts.

PROBLEMS AND GUIDELINES FOR MICRO MANPOWER PLANNING

The basic *purpose* of micro manpower planning is to enable an organization to attain its goals and objectives more surely, faster, better, and/or cheaper. There may be two closely related and additional objectives: To enable employees to attain their employment objectives; and to attain social goals and objectives, such as hiring and training disadvantaged workers.

At the outset, it is necessary to determine needs for, and uses of, formal manpower planning in a firm or employing organization. The vast majority of firms (especially small firms with under 100 employees) may not need formal manpower planning. They may be able to get by with "seat of the pants" estimates and common sense, plus assistance from the public employment service. Larger organizations, however, are likely to need their own formal planning efforts.⁵³ But no organization should have formal manpower planning unless the benefits clearly outweigh the costs, which are apt to be considerable.

The basic *results* from successful micro manpower planning are enhanced effectiveness and efficiency in causing change (as well as in responding to anticipated changes) through better use of manpower resources. Manpower resources include not only numbers and special skills, but motivation, efforts, and outputs as well. In a highly sophisticated technological society, quantity of manpower resources frequently must take a back seat to quality; knowledge and brainpower are at a premium.

The basic *problems* of manpower planning come from the complexity of modern employment relationships. In

a democratic, free enterprise economy—with a vast array of consumer, personal, worker, and employer freedoms—planning is difficult if for no other reason than that there are so many decisionmakers.⁵⁴ But to this one must add the fantastic variety of needs, goals, behaviors, perceptions, variables, and interactions of the parties to employment relationships, as well as those in the community at large. The need to try to make order out of complexity is a compelling reason for an employing organization to use a systems framework or approach—to deal with organizational and people problems in a sensible way.⁵⁵ The renewed emphasis upon planning and systems approaches is among the most significant of modern management trends. Micro manpower planning requires a manpower systems approach for optimal performance.

To state the basic problem in a slightly different way, manpower planning involves many alternatives, choices, and strategies—it is formal decisionmaking involving both logic and numbers. The problem may be likened to the theoretical entrepreneur in simple labor economics

⁵⁴ Cf. Dale Yoder and H. G. Heneman, Jr., *Manpower Blueprint for a Free Economy* (Washington: 82d Cong. 2d session, U.S. Senate, Committee on Labor and Public Welfare, 1953).

⁵⁵ Cf. H. G. Heneman, Jr., "Toward A General Conceptual System of Industrial Relations," *Essays in Industrial Relations Theory*, ed. Gerald A. Somers (Ames, Iowa: The Iowa State University Press, 1969), pp. 3-24. See also Walter Buckley, *Sociology and Modern Systems Theory* (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1967), pp. 1-80; A. W. Charnes, W. W. Cooper, and R. J. Nickhaus, *A Goal Programming Model for Manpower Planning* (Pittsburgh: Carnegie-Mellon University, Graduate School of Industrial Administration, December 1967), ONR Management Science Research Report No. 115; and A. W. Charnes and others, *A Model and a Program for Manpower Management and Planning*.

⁵³ The majority of employees work in these larger firms and employing units, which helps explain the critical importance of manpower planning.

analysis, that is, in what proportions should he use factors of production? Which recipe of inputs will yield the optimal payoff? Should he use more labor, or more machinery? More skilled or more unskilled? White collar or blue collar?

Unlike the classical marginal productivity theory with its "givens" (everything else remaining equal), the real world is a dynamic open system with new and changing variables and forces coming into the problem-solving matrix of the employer. Hence past experience, and simple projections of past experience, are generally inadequate. Further, the basic units in manpower planning are people—who are more variable and changing units than money or bricks and mortar. It is much easier to plan almost any other part of a business (for example, working capital requirements) than to make reliable and valid manpower plans.

Some Principles of Micro Manpower Planning

1. Although manpower planning involves both present and potential employees, it should be especially concerned with workers who are already on the payroll. They may not be properly placed, trained, motivated, or supervised. Indeed, most firms might want to consider retraining present employees before hiring or training new ones. Obsolescence of job knowledges, technologies, and skills and bad habits or methods of work may require emphasis upon unlearning and relearning.⁵⁶ An increase in the efficiency of present employees may be a better solution to manpower needs than hiring additional workers. Frequently some combination of the two may be best.

2. Manpower planning is dynamic—it requires lead time. Plans must be made to have the right kind of manpower resources in the right place, in the right amount, at the right time. This requires not only forecasts of needs, but also programs to meet needs, assigning responsibilities for these programs, and a series of tests to insure that plans proceed according to schedule. Programs must be flexible and adjustments made to a variety of developments. Dynamic plans consist of a continuing series of successive approximations.

⁵⁶ Cf. Richard Kislik and Alfred R. Lateiner, "Repeater Training Helps Us Win Our War on Waste," *Factory Management and Maintenance*, March 1951, pp. 94-96 and pp. 248 ff.

3. Each employing organization must tailor its plans and programs to its own circumstances and special needs. There is no successful way to borrow someone else's programs. It is desirable to lay out a flow chart of manpower processes or transactions.

4. Since much information must be collected and collated for manpower planning, a computer can be helpful. However, planning without access to a computer is possible (and for some companies preferable). A computer may tempt planners to store interesting bits of information on a memory drum, that is, to think in terms of data inputs. This approach, while widely used, is exactly backwards. It is essential to start with outputs desired from the computer and then plan to gather data needed to supply these information outputs.

5. Manpower planning should provide incentives for all who participate in the process, not just the planners. Manpower planning faces resistance to change in many forms; this resistance should be anticipated and steps to overcome it built into the planning system, or the plans will not be used. Manpower planning is costly—but costs must be weighed against benefits.

6. Manpower planning requires deliberately planned, formal evaluation and controls. It is essential to build in formal feed-back loops so that, when standards are not being met, information comes back promptly in time to trigger corrective actions. Simple quality-control type charts, for example, can do the job.⁵⁷ The important element is the cost-benefit control concept. Staffing standards are of particular importance; wherever possible they should be set by work measurement techniques.⁵⁸ Then they should be used to build manning tables and staffing schedules or personnel inventories.⁵⁹

7. Ideally, manpower planning calls for separate but coordinated plans for the overall organization, subunits, job families, and employees. For each employee, it is essential to prepare an individual gap sheet, showing his job requirements minus his present skills. Indeed, he should preferably have an additional gap sheet for some other (usually higher level) job, which should be the basis of a development program for him.

⁵⁷ Cf. Adam Abruzzi, "Personnel Research and Statistical Charts," *Personnel*, July 1947, pp. 46-53; Adam Abruzzi, "Applying the Control Chart Method to Work Evaluation and Incentive Plans," *Personnel*, November 1948, pp. 204-210; and Martin H. Saltz, "How to Move Fast on Accidents," *Factory Management and Maintenance*, December 1950, pp. 86-88.

⁵⁸ Cf. Herbert H. Rosenberg, "Work Measurement in the Personnel Office," *Personnel Administration*, September 1947, pp. 17-24; and Herbert H. Rosenberg, "Staffing for Civilian Personnel Offices," *The Personnel Digest*, October and November 1953, p. 10.

⁵⁹ Cf. Dale Yoder and others, *Handbook of Personnel Management and Labor Relations* (New York: McGraw-Hill Book Co., Inc., 1958), pp. 5.42 and 5.43.

8. The gap sheet totals will provide information needed in making inside (training) versus outside (recruiting) manpower labor supply decisions. The sum of all individual gap sheets should indicate the scope of the company's training program.

9. A manpower planning program should be set up to *cause* change. It should start with clear goals ("Here's what we want") and plan the means for reaching them. Frequently, micro manpower planning is a sterile exercise; that is, it results in manpower forecasts without plans for action. Planning should begin with objectives and needs and then inventory current manpower resources. The difference is the total manpower gap. Manpower planning should provide not only measures of the gap, but also positive plans to bridge it.

10. Planners must understand past and present variations in employment levels if they are to do a good job of prediction and control. Usually, at the outset of manpower planning in a firm, many guesses and/or assumptions must be made. It is essential that these assumptions be recorded and made explicit so that those charged with evaluating and improving subsequent manpower plans can identify any faulty assumptions. Wherever possible and feasible, assumptions should be documented with data series on such variables as expected sales, changes in plant and worker efficiency, expansion, and internal and external labor supplies. Obviously, the specific variables and their importance will differ among organizations.

11. A simple method of discovering the reasons for variations in employment levels was used by one of the major companies in our survey. Each week, each employing unit (such as a department) listed total man-hours worked and total employees (by job class) for the past and the current week. The unit then accounted for the differences between the two weeks; for example, "it snowed," "we made a faulty run on our Tuesday batch of widgets," etc. This was done by the foreman or department head. Over a period of time it was possible to discover what variables actually were involved, and which of these could have been anticipated. Such an inductive approach will give the basis for a tailor-made model in the firm. It provides the important "experience factor" needed for manpower planning.

12. But experience accounts for only the past and present; manpower planning and forecasting are concerned with the future. Hence it is necessary to bring in expectations. Sometimes, top management does not want lower levels of management, or staff personnel, to know of all of its plans for the future. Knowledge of mergers, acquisitions, and new products may be privileged information. If manpower planners are unaware of

management plans, it is obviously essential that somebody in authority modify manpower plans on the basis of known plans for change, with further refinements based on secret plans. The modifications should be planned and formalized.

13. Manpower planning should aim at covering all major manpower areas in minimal fashion rather than concentrating upon only one area in excessive detail. Thus, for example, it is generally better to integrate plans for internal employee development with plans for external recruiting than to develop a recruiting schedule that gives projected needs to 20 decimal places without planning for employee training. Only the significant should be planned; excessive detail is often fatal to manpower planning.

Guidelines in Micro Forecasting

Overall Design

In forecasting manpower requirements, the following steps are desirable:

1. Lay out the objectives of the forecasts or predictions. (Hopefully, there will be several objectives.)
2. Assign priorities to these objectives. (Do not always assume that recruiting is first; knowledge of "why" some goals are more important than others is vital to planning.)
3. Try to determine what data are needed. They may be available either internally or externally (for example, unemployment levels in a specific local labor market may be obtained from the local public employment service).
4. Determine which data can be of "snapshot" or cross-sectional nature, and which need to have a "movie" or longitudinal base. Check the possibility of using sampling (by time periods, by departments, etc.).
5. Make plans to evaluate thoroughly both the reliability and the validity of data used in projections. Basing projections on data of unknown quality invites errors—yet this is a common current practice.
6. Regard manpower forecasting as part of a total manpower planning package; that is, it should be looked upon as a long-term investment in manpower resources, rather than a short-term cost. Ideally, manpower fore-

casting (and planning) should be related to a program of human assets accounting.

Procedures for Identifying and Estimating Predictors

Sales or production forecasts are commonly used to predict manpower requirements. Typically, historical relationships between one or the other and employment are established. Generally, these relationships are not stable. One forecasting approach controls the lack of stability statistically with a technique called exponential smoothing, which essentially emphasizes the more recent relationship between sales or production and manpower needs. A second approach takes into consideration the factors affecting the relationship.

Identification of the underlying factors is preferable for two reasons. First, relationships between sales or production and employment can be affected by non-recurring events. The statistical approach will identify the impact of such an event but will produce an erroneous projection because it assumes the event will continue to occur.

The second reason is that more accurate predictions can be made if the impact of significant intervening variables is identified and considered in manpower forecasting. Some organizations have had difficulty using sales as a predictor because of such factors as inflation, rising costs of production, and production for inventory. Ignoring the impacts of these factors can lead to inaccurate estimates of relationships between sales and manpower requirements. If allowances for these influences cannot be made in the sales forecast, it may be preferable to base manpower forecasts on production estimates.

Whether sales or production is used, relationships with employment will usually also be influenced by product, administrative, and technological changes. The problem of predicting change and its impact is especially difficult if the firm is a leader in its product field or in developing technological and administrative innovations. Methods of anticipating change suggested by the case studies indicate that maintaining contact with appropriate outside research units helps in predicting the more distant future, and maintaining contact with the organization's research and industrial engineering departments is helpful for the more immediate future.

When a new or different product is being made, great increases in efficiency can be anticipated as employees become familiar with the product. For example, data on learning curves gathered in aircraft assembly indicate

that, when the number of units produced doubles, time required per unit decreases by 80 percent.⁶⁰ This finding suggests that, in organizations experiencing frequent product change, some consideration should be given to learning curves. Learning curves may also be relevant whenever a worker is not familiar with a job. Examples are new employees and persons recently transferred or promoted.

The problem of predicting change and the impact of change is greatly simplified when the organization is not leading in its development and implementation. This situation is probably more common. Typically, organizations lead in developing and implementing only limited numbers and types of innovations. Most changes are borrowed or bought from other firms. Planners can obtain information which predicts change and its impact through trade or other associations and from other sources. When innovations are marketed, information indicating the manpower implications of the changes is often made available by the developer.

Information on both internal and external labor supplies is pertinent for predicting manpower requirements and for manpower planning. Typically, organizations which consider external labor supplies rely on government sources for forecasts of labor supply and information describing the current labor supply, but in some instances this information is not fully adequate. At present it may be too general to be very useful in projecting specific labor requirements for a small firm. Data are needed for specific occupational groups and geographic areas. A few organizations are gathering such information, and the U.S. Department of Labor is making available much more local and area data, as noted previously.

As with external labor supplies, it is useful to identify and project the quality and the quantity of internal labor supplies. The usual approach to identifying current quantity is a skills inventory adjusted for separation rates. Forecasting quality is more difficult.

One approach to the quality problem is to plan the training each employee is to receive (gap sheets), and an alternative is to identify average rates of progression in typical promotion routes. A third alternative would have each supervisor estimate when each of his subordinates will be ready for promotion to specific positions. In certain situations the last technique would appear to be desirable. Where promotion is usually based on experience or informal training such as coaching (rather

⁶⁰Winfred B. Hirschman, "Profit From the Learning Curve," *Harvard Business Review*, January-February 1964, pp. 125-129; and William Rudelius, "Lagged Manpower Relationships in Development Projects," *IEEE Transactions on Engineering Management*, December 1966, pp. 188-195.

than formal training), the first alternative would be inadequate. Where individual rates of development and/or promotion routes are quite variable, reliance on averages would be inadequate. Clearly, the approach which is applicable depends on specific manpower needs in the firm's particular circumstances.

Trends in separation rates typically enter into projecting the quantity of internal labor supply. A number of considerations for forecasting this aspect of internal supply were suggested by the exploratory probe:

1. It is advisable to estimate separation rates by occupational group because of variance in rates by skill level.
2. Identification of retirement dates is important at all levels, and especially for the higher management positions because several years may be required to develop replacements.
3. In short-run forecasting and planning, considering dates and lengths of vacations can be valuable.
4. Trends in separation rates appear to be influenced by alternative employment opportunities; therefore, more accurate projections of separation rates may be possible by adjusting them for economic activity.

Relating Predictors to Manpower Requirements

The principal differences in relating predictors to manpower requirements involve precision or detail. Many firms base their manpower projections on forecasts of aggregate sales or production. Others base them on forecasts of sales or production by product. An obvious advantage of the latter technique is that it accounts for at least part of the changes in manpower requirements resulting from product change. An even more refined approach is to identify the purpose or function of each job and relate it to sales or production. In essence, the planner is forecasting the work for each job. In general, the procedure is to identify the time required per unit of work for each job, forecast the number of work units (workload) for each job, and multiply the two together to forecast man-hours required.

It is reasonable to expect that in some organizations labor needs for some jobs do not vary with production. Case A describes an organization which draws a distinction between variable labor requirements, or those which are a function of the level of production, and fixed labor requirements, or those which are not so directly related to the level of production. The jobs classified as fixed are viewed as constants in manpower forecasting.

It seems advisable to project a *range of labor needs* because of the large number of factors that affect manpower requirements and the difficulties in estimating the future state of these factors. Essentially, the procedure is to forecast the most probable labor requirements, the likely maximum requirements, and the likely minimum requirements. Forecasting a range of needs guides planners in devising contingency plans to meet requirements if they depart from the most probable forecast.

Forecast Requirements for Which Employee Groups?

Forecasting the total manpower requirements of an organization generally is not sufficient. A number of the survey respondents reported relatively small changes in total employment during the past few years, but experienced significant changes in the skill composition of their work forces. To plan recruiting, training, transfers, and other manpower related activities, it is necessary to project requirements for specific occupational groups, and for specific geographic areas if the organization has more than one location.

Some respondents forecast requirements by position for top management level and key jobs, because it is crucial to have capable individuals in these positions and the supply of such personnel is limited.

Who Should Prepare Manpower Forecasts?

Those responsible for forecasting must have access to *all* relevant information, but this was not the case in the firms studied. The most frequently mentioned change believed to be necessary for better forecasts was the need to be fully informed of company plans and objectives. In some cases it was standard procedure for top management to revise projections on the basis of information not available to those responsible for manpower forecasting.

A principal consideration in determining responsibility for the forecasting activity should be who has or can obtain the necessary information. It is probable that at the present time neither most line managers nor personnel managers—the persons who usually made the forecasts in the firms studied—have all the necessary information. There are at least three alternatives to deal with this problem. Either line managers or the personnel

department can prepare the forecasts, and the other can supply relevant information to those responsible for forecasting. Or both can prepare manpower forecasts and then meet to resolve differences. Or the function of manpower planning and forecasting can be assigned to a position under the supervision or a person privy to all needed information.

The Frequency of Forecast Preparation

How often manpower forecasts should be prepared depends largely on the frequency of changes that affect needs and the ability to predict these changes. For example, an organization whose business depends on long-term contracts may not need to prepare forecasts as often as one whose production is less predictable.⁶¹ Intervals of 1 year or more were predominant among the surveyed organizations, apparently because many believed that changes during a year would be small, or at least predictable. In the survey, the organization with the most accurate predictions prepared them every 2

⁶¹ This consideration has implications for the length of the forecast period discussed below.

months and regularly updated the relationship between predictors and manpower requirements.

Another consideration in determining frequency of preparation is the length of time covered by the forecast. One-year forecasts prepared quarterly, for example, maintain at least a 9-month lead time for meeting requirements, whereas an annual 1-year forecast is of no use just prior to preparing a new forecast. It would seem preferable to use a rolling forecast approach.

Length of the Forecast Period

The two most common forecast periods used by reporting units were 1 year and 5 years. Two important considerations in determining the length of the forecast are its accuracy and its uses. The survey results suggest that most of those preparing only 1-year forecasts used them to guide recruiting, whereas a greater proportion of those preparing longer forecasts used them to guide such activities as training, transfers, and promotions. For the relatively fixed positions, or those which tend to vary comparatively little with business activity, a longer forecast permits the development of an internal supply. There is, however, little value in forecasts covering 5 or 10 years if they are essentially guesses.

RESEARCH NEEDS

Research and experimentation in micro manpower planning should be done within the firm, outside the firm, and jointly.

Within the firm, it might be desirable to:

1. Experiment to determine the most effective way to build a *total* manpower systems approach within the firm.
2. Within the total system, attempt to determine which modules can be worked on separately (and still effectively) and establish priorities as to which parts or modules should be developed first.
3. Test possibilities of relating manpower planning systems to human assets accounting systems and management information systems.
4. Experiment with the most effective organizational arrangements within the firm to facilitate and improve planning efforts (and results). Thus, for example, communications might be developed to report back on consequences of improved manpower planning; special incentives could be tried to reward successful manpower planners and forecasters, especially those who make improvements. Successful manpower planning and forecasting are, in part, "attitudinal." If a manager cannot see any particular benefits that *he* derives from the reports, if they are just more papers to be filled out for some unknown reason, then manpower planning and forecasting have little chance to be effective. If, conversely, manpower planning helps the manager to do his job better and is viewed by him as helpful and supportive (rather than required), it has a better chance to be effective.
5. Devise ways to do cost-benefit analyses of micro manpower planning.
6. Within a general framework of micro manpower

planning, experiment with micro manpower forecasting. Plan to devise improved forecasts of *both* manpower demands and supplies, and their relationships. For each, test specific assumptions and sources of underlying data, their reliability and validity; and explore the possibilities of selecting better predictors or assigning better weights to the predictors, of developing forecasts by job families, occupations, and skill groups, of predicting a range of requirements and supplies for each occupational group, and of using more sophisticated prediction techniques, such as stochastic process models, for forecasting labor supplies.

Outside the firm, and jointly, some major areas for research are:

1. Conferences and publications reporting results of experiments in micro manpower planning and forecasting.
2. Impacts of subsidies and grants for more advanced experimental work (such as simulation models). It is increasingly clear that simplistic solutions based on experience will not suffice in an era of dynamic change.
3. Possibilities of devising effective systems and programs for formal manpower planning in small firms (those of 100 employees or fewer and possibly those under 500). Perhaps such systems and programs will need to be installed and maintained jointly with a public manpower agency. Perhaps trade associations can be usefully involved.
4. Experiments involving unions, community action groups, vocational schools, and others who can play a large role in the effectiveness of micro manpower programs. At present, they are involved (if at all) by indirection, haphazardly, and perhaps at arm's length. We need to experiment to see what can be done to make

these organizations a more effective and integrated part of manpower planning systems. It is high time that manpower planning systems embrace variables beyond the confines of the firm (closed systems) and recognize the impacts of significant outside variables and groups already affecting their manpower programs (open systems). In addition, we need to determine ways and means for the government to supply more and better local manpower data for firms to use in their micro manpower planning.

5. Experiments with indicative planning efforts and techniques, macro and micro, private and public, such as those carried out in Western Europe. These experiments could be simulations at first—their potential costs and benefits should be assayed. Such attempts should not be damned in advance with emotional slogans and name

calling, but should be judged on the basis of objective evidence as to their effectiveness.

Micro manpower planning is in its infancy. There is substantial "cultural lag" in application of currently available approaches and methods. The strains on manpower resources in employing organizations will probably compel these organizations to devote more attention to avoidance of manpower problems. Hopefully, the approaches used will be preventive rather than remedial. Perhaps some of the suggestions from the Minnesota exploratory probe will stimulate more, and more successful, experimentation within firms and other basic employment units. The firms included in this pilot study provide us all with inspiration and with instructive examples of how to improve in this vital function.

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